THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

[Registered as a Newspaper.]

Vol. XXXIV. No. 847.] LONDON, AUGUST 5, 1879. [31st Year.] Price 6d.

GAS PURIFICATION
BY
OXIDE OF IRON.

COOKE BROS.,
CENTRAL DEPÔTS:
CO. DONEGAL, IRELAND;
LONDON DEPÔT:
BLACKWALL, E.;
OFFICES:
26, 27, & 28, FENCHURCH ST.,
LONDON, E.C.

GENUINE TORBAY PAINT
And SPECIAL GASOMETER PAINT.
Several Prize Medals. Established over 20 Years.
These Paints are now used in over 200 Country Gas-Works, and by all the London Gas Companies, on Gas-holders, Scrubbers, Purifiers, &c. Also used by the Admiralty, War Office, Railway Companies, Founders, &c. They prevent and arrest rust, and protect iron from the action of water, sulphurous and gaseous exhalations; do not crack, blister, or flake off; will cover tar effectually.
The covering powers are considerably greater than those of any other Paint.—*See "Engineer," Nov. 2, 1866.*
Supplied, mixed ready for use, or in paste, as desired.
TORBAY PAINT COMPANY.
Proprietors: STEVENS & CO.,
21, GREAT WINCHESTER STREET, LONDON.
Works: BRIXHAM, TORBAY.

THOMAS PROUD,
BROOKFIELD GAS APPARATUS WORKS,
103, ICKNIELD STREET EAST, BIRMINGHAM.
CONTRACTOR FOR
LAYING MAINS
FOR
Gas, Water, & Sanitary Purposes,
AND MANUFACTURER OF
WOOD GRIDS
FOR
SCRUBBERS AND PURIFIERS.

COWEN'S PATENT FIRE-CLAY RETORTS.
JOSEPH COWEN and CO.,
BLAYDON BURN, BLAYDON-ON-TYNE,
Were the only parties to whom a Prize Medal was awarded at the Great Exhibition of 1851, for "Gas-Retorts and other Objects in Fire-Clay," and they were also awarded at the International Exhibition of 1862, the Prize Medal for "Gas-Retorts, Fire-Bricks, &c., for Excellence of Quality."
J. C. and Co. have been for many years the most extensive Manufacturers of Fire-Clay Retorts and Fire-Bricks in the Kingdom. Orders for Fire-Clay Retorts of all shapes and dimensions, and to fit any shaped Mouthpiece, Fire-Bricks, and every other article in Fire-Clay, are promptly executed at their Works as above.
COWEN'S GARESFIELD COALS.
Jos. Cowen & Co. are the only Manufacturers of Fire-Bricks and Clay Retorts at Blaydon Burn.

JOHN RUSSELL & CO.,
LIMITED,
Established at the commencement of Gas Lighting,
Manufacturers of
TUBES AND FITTINGS.
THREE PRIZE MEDALS,
Paris, 1878.
Head London Office:
145, QUEEN VICTORIA STREET.
ALMA TUBE-WORKS, WALSALL;
OLD PATENT TUBE-WORKS, WEDNESBURY.

JOHN BENT & SON,
BELL BARN ROAD, BIRMINGHAM,
Manufacturers of
WET AND DRY GAS-METERS,
Licensees and Manufacturers of
HUNT'S
PATENT COMPENSATING METERS,
STREET-LAMPS, &c., &c.
Established 1830.

THOMAS PIGGOTT & CO.,
SPRING HILL, BIRMINGHAM,
Manufacturers of
TELESCOPIC & SINGLE GASHOLDERS,
CAST & WROUGHT IRON TANKS FOR DITTO,
And Gas Apparatus of every Description.
Marine, Tubular, Cornish, Plain, Furnace, Saddle, and Range Boilers.
Sugar, Saltpetre, and all kinds of Pans.
Roofs, Girders, and Bridges, and General Smith's Work.
London Offices: 97, CANNON STREET—
JAMES E. & SAMUEL SPENCER, Agents.

THE
"OTTO" GAS-ENGINE.
See Page 206.
CROSSLEY BROTHERS,
MANCHESTER AND LONDON.

THE
NITSHILL COMPANY'S
DUKE OF HAMILTON'S
LESMAHAGOW
CANNEL COAL.
AGENT:
JAMES M'KELVIE,
HAYMARKET,
EDINBURGH.

CHANGE OF ADDRESS.
GEORGE GLOVER AND CO.,
DRY GAS-METER MANUFACTURERS,
HAVE REMOVED TO MORE EXTENSIVE PREMISES:

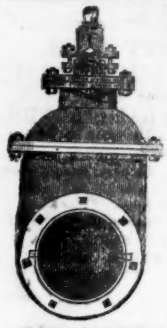
RANELAGH WORKS, ROYAL AVENUE, CHELSEA, LONDON, S.W.

WELLINGTON TUBE WORKS,

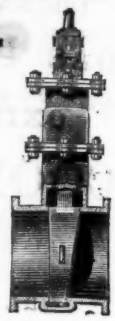
GREAT BRIDGE, TIPTON, STAFFORDSHIRE.

JOSEPH AIRD,

GAS, STEAM, AND HYDRAULIC TUBES AND FITTINGS.



C. & W. WALKERS' DOUBLE-FACED GAS-VALVES.



These solidly constructed double-faced Gas-Valves have taken the place of the old system of the light, single-faced disc, which is too uncertain and unreliable in large bores.

They are guaranteed absolutely gas-tight. They are very massive and rigid, and by improved modes of manufacture they are produced at very little excess in cost over the old light, weak system, which is liable to spring and bend, and become leaky.

The Valve is a rigid wedge of solid cast iron, having two perfectly scraped surfaced facings fitting between the two on the body, which are also surfaced.

A spring in two short halves, and, therefore, not liable to break, is used only for scraping the front facing clean.

The front facing is vertical; the back facing forms the wedge.

At a slight additional expense both flanges are faced to bolt to main-pipes.

MIDLAND IRON-WORKS,

DONNINGTON, near NEWPORT, SHROPSHIRE; 8, FINSBURY CIRCUS, LONDON.

EDWARD E. CROMBIE & CO.,

INVENTORS AND PATENTEES

OF THE

FRICTIONLESS DRY GAS-METERS,

Beg to intimate to Gas Companies and others that they are now prepared to supply these very superior Meters at the same prices as for the ordinary Gas-Meters.

In the construction of this Meter, for which the best tin plates only are used, every mechanical contrivance has been taken advantage of successfully to reduce the friction to a minimum, which is amply proved by the fact that they are made to work upon only one-fortieth of an inch pressure. By an improvement also in their construction, a steadier light is obtained, and greater capacity than can be got from any other Meter in the market. No gas can pass under the valves on any back pressure, as is the case with many other Dry Meters.

To Gas Companies supplying gas through streets with heavy gradients, these Meters are invaluable, as much gas is saved from the low pressure required to work them.

ALL METERS ARE UPHELD FOR FIVE YEARS.

METROPOLITAN WORKS, DIANA PLACE, EUSTON ROAD, LONDON, N.W.

SAMUEL CUTLER & SONS,

CONTRACTORS FOR GAS & WATER WORKS, GENERAL ENGINEERS, IRONFOUNDERS & MANUFACTURERS OF

GASHOLDERS, TANKS, PURIFIERS,

SCRUBBERS, VALVES, EXHAUSTERS, IRON ROOFS, BRIDGES, BOILERS, AND GENERAL CAST AND WROUGHT IRON WORKS.

S. C. & Sons undertake the entire erection of New, or Remodelling of existing Gas-Works in any part of the World, including small Works for MANSIONS, FACTORIES, &c., or Works of the largest extent (are now constructing the largest Gasholder yet erected); also the supplying and laying of MAINS.

They make a speciality of supplying every requisite whatever for Gas-Works, keeping in Stock what are most in request. WOOD SIEVES for Purifiers and Scrubbers, of a superior make.

SPECIAL CASTINGS to Drawing or Pattern at Shortest Notice.

Manufacturers of MORRIS & CUTLER'S PATENT CONDENSER & CUTLER'S PATENT GAS-WASHER.

DESCRIPTION OF MORRIS & CUTLER'S PATENT CONDENSER.—The Condenser may consist of pipes arranged in tiers, or in any other form most convenient to the site available, each tier being connected with special connections, and containing within same either one or more coils of smaller pipe through which water is passed, being supplied from any convenient source of supply, the water passing in an opposite direction to the gas, so that the coldest water is at the gas outlet. The power of the Condenser can be regulated precisely in proportion to the quantity of water allowed to pass through, which is not in any way contaminated, but simply heated by the hot gas, and advantage can be taken of its being at a high level to carry it to a high-level cistern, from whence it can be used for supply to boiler or any other purpose. The Condenser itself may form the support for a high-level cistern. By an arrangement of valves the water may be shut off, and an air orifice opened, when air will pass through instead of water, or both air and water can be shut off. The power of the Condenser is, therefore, entirely under control. The Condenser may be seen in operation at the Brentford Gas-Works.

For further Particulars, apply to Mr. F. MORRIS, GAS-WORKS, BRENTFORD, or to

S. CUTLER & SONS, PROVIDENCE WORKS, MILLWALL (Near the Steamboat Pier), LONDON, E.

TRADE MARK.

THE MEDAL FOR 1862.

The only Prize Medal awarded for TUBES & FITTINGS.

CROWN TUBE-WORKS,

WEDNESBURY, STAFFORDSHIRE.

WAREHOUSE: SOUTHWARK STREET, LONDON.

JAMES RUSSELL & SONS, LIMITED,

PATENTEES & FIRST MAKERS OF WROUGHT-IRON TUBES,

ONLY MAKERS OF HOMOGENEOUS METAL TUBES.

MANUFACTURERS OF

TUBES and FITTINGS for GAS, STEAM, and WATER;

LAP-WELDED, LOCOMOTIVE, MARINE, and other BOILER TUBES;

HYDRAULIC TUBES, BEDSTEAD TUBES, WELL TUBES, TELEGRAPH POSTS, COILS, &c.

GAS-FITTERS TOOLS, VALVES, COCKS, &c.

THOMAS PIGGOTT & CO.,

(Established 1822,)

SPRING HILL, BIRMINGHAM.

MANUFACTURERS OF

TELESCOPIC & SINGLE GASHOLDERS,

CAST & WROUGHT IRON TANKS FOR DITTO;

PURIFIERS, CONDENSERS, SCRUBBERS, RETORTS, VALVES;

IMPROVED WROUGHT-IRON RETORT-LIDS, CROSS-BARS, & SCREWS;

AND GAS APPARATUS OF EVERY DESCRIPTION.

SOLE MANUFACTURERS OF LIVESEY'S PATENT GASHOLDER MAN-LID,

By use of which Man-lid, inlet and outlet pipes can be examined and cleansed without loss of gas in crown of holder, or ingress of atmospheric air.

ROOFS, GIRDERS, BRIDGES, AND BOILERS OF ALL KINDS.

Drawings, Specifications, and Estimates supplied on application.

LONDON OFFICES: 97, CANNON STREET—JAMES E. & SAMUEL SPENCER, AGENTS.

HONOURABLE MENTION.

J. E. WILLIAMS & CO.,

PARIS EXHIBITION, 78.

SOLE MANUFACTURERS OF THE

SPECIAL METALLIC OXIDE PAINT,

Largely used by Gas Companies, Corporations, Railway Companies, Ironfounders, and Machinists. It has the following qualifications and properties:—

EFFECTUALLY PREVENTS AND ARRESTS CORROSION.
HAS A FINE GLOSS, AND IS VERY DURABLE.
DOES NOT REQUIRE DRIERS LIKE OTHER PAINTS.
PROTECTS IRON FROM ACTION OF WATER.

IS NOT AFFECTED BY SULPHURETTED HYDROGEN.
FORMS A VERY HARD TOUGH (NOT BRITTLE) SURFACE.
WILL NOT CRACK, BLISTER, OR SCALE
IS NOT AFFECTED BY EXTREMES OF TEMPERATURE.

COVERS NEARLY DOUBLE THE AREA OF OTHER PAINTS.
(7 gallons or 1 cwt. will cover 1211 square yards of Ironwork.)
IS CHEAPER AND MORE ECONOMICAL THAN ANY OTHER.

VICTORIA PAINT WORKS, COLLYHURST, MANCHESTER.

HYDRATED PURIFYING MATERIAL.

Samples on application.

MESSRS. SPENCE BROS., LIMITED,

Will be glad to supply the above on the most favourable terms, and to treat, by Purchase or Exchange, for Spent Oxide.

PRICES ON APPLICATION.

ALSO PATENT DRY COPPERAS FOR EXTRACTING AMMONIA.

VICTORIA CHEMICAL WORKS, BRADFORD, NEAR MANCHESTER.

ROBT. DEMPSTER & SONS,

GAS ENGINEERS, IRONFOUNDERS, AND CONTRACTORS,

ROSE MOUNT IRON-WORKS, ELLAND, YORKSHIRE.

MANUFACTURERS OF EVERY DESCRIPTION OF

GAS APPARATUS;

CONTRACTORS FOR THE

ERECTION OF PUBLIC AND PRIVATE GAS-WORKS.

Plans and Specifications Prepared, and Illustrated Catalogues forwarded on application.

DANIEL HOWARD,

(Successor to the late BENJ. WHITEHOUSE),

GASHOLDER AND BOILER WORKS,

WEST BROMWICH, NEAR BIRMINGHAM (Established 1765),

MANUFACTURER OF

TELESCOPIC AND SINGLE GASHOLDERS,

WROUGHT AND CAST-IRON TANKS FOR DITTO.

PURIFIERS, CONDENSERS, SCRUBBERS, HYDRAULIC MAINS, AND ALL KINDS OF GAS APPARATUS.

WROUGHT-IRON ROOFS, BRIDGES, GIRDERS, ETC.

STEAM, HOT WATER, AND RANGE BOILERS, TANKS, CISTERNS, BOATS,

AND ALL KINDS OF WROUGHT-IRON WORK.

Drawings, Specifications, and Estimates supplied on application.

GAS PURIFICATION
BY
OXIDE OF IRON.
GAS PURIFICATION & CHEMICAL Co., LIMITED,
PALMERSTON BUILDINGS, OLD BROAD STREET, LONDON, E.C.

JOHN WM. O'NEILL, Managing Director.

THE WIGAN COAL & IRON COMPANY,
LIMITED,

DISTRICT OFFICE: 97, NEW STREET, BIRMINGHAM; AGENT: W. M'GOWAN,

Supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, &c.

N.B.—The Wigan Coal and Iron Company, Limited, are exclusive owners of the well-known HAIGH HALL AND KIRKLESS HALL GAS COAL COLLIERIES.

GAS COAL. GAS COAL. GAS COAL.

WELLS, BIRCH, RYDE, and CO., Limited,

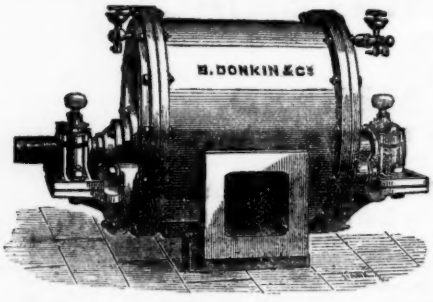
HOYLAND SILKSTONE COLLIERIES,
Near BARNSLEY.

This Company is now in a position to raise **2000 tons per day of REAL OLD SILKSTONE GAS COAL.**

"The quality of this Coal for Gas purposes, if equalled, is not excelled by any on record, and the Coke competes successfully with best Durham."—See *Mining Journal*, Aug. 11, 1877.

Prices quoted to any Railway Station, or F.O.B. Hull, Grimsby, Goole, Keadby, Liverpool, and Fleetwood.

Full particulars will be sent on application to above address.



J. BEALE'S
NEW PATENT GAS-EXHAUSTERS,
For the Manufacture of which

MESSRS. B. DONKIN & Co.

POSSESS THE SOLE RIGHT.

Made with two Outside Bearings and with all the Latest Improvements.

FULL PARTICULARS ON APPLICATION.

BERMONDSEY, LONDON, S.E.

Messrs. B. D. & Co. are also Manufacturers of Steam-Engines and of Improved Gas and Water Valves, &c., &c.

GOLDSMITH'S PATENT SIGHT WATER-LINE INDICATING GAS-METER.
MANUFACTURED BY GUEST AND CHRIMES,
FOUNDRY AND GENERAL BRASS WORKS, ROTHERHAM;

AND 85, SOUTHWARK ST., LONDON, S.E.

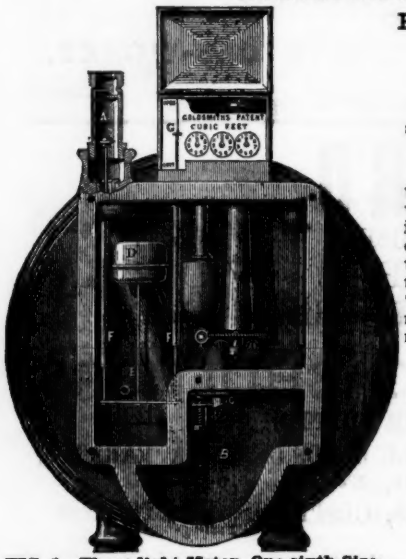


FIG. 1.—Three-light Meter, One-sixth Size.

Fig. 1 is a Meter with front removed to show the arrangement and connection of the Indicator and Valve.

Fig. 2 is front view of Index, with cover up.

The principal object of this invention is to render the water-line in the reservoir at all times visible. It will be seen, by reference to the illustrations, that this is accomplished in the following manner:—On the dial are the words "Open" and "Shut," and attached to the float is the pointer G, which rises and falls with the water-line in the reservoir. If the pointer is at "Open," it shows that the valve is open, and that the reservoir is full. If it is at "Shut," it shows that the reservoir is empty, and that the gas will be shut off.

The following ADVANTAGES will be obvious:—

1. The Inspector can see at a glance if the Meter requires water.
2. No more water than is required need be added, and therefore no water has to run out.
3. The Meter Inspector will be spared a great deal of his most objectionable work, and he will save a great deal of time and trouble.
4. The consumer will not always have to be asked for water, nor will he have to endure the unpleasant smell caused by waste water being run out.

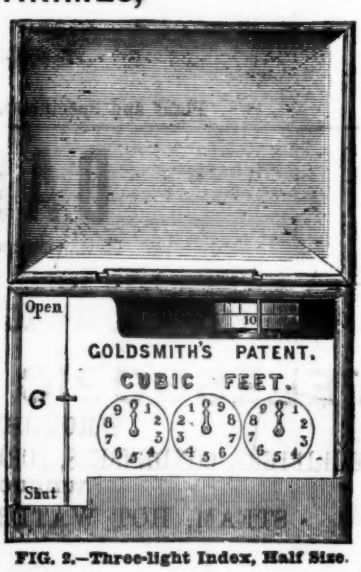


FIG. 2.—Three-light Index, Half Size.

GEORGE ORME & CO.,

ATLAS METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET AND DRY GAS-METERS,

STATION-METERS, GOVERNORS,

PRESSURE AND EXHAUST REGISTERS,

LAMP-METERS IN CAST-IRON BOXES,

And every Description of Gas Apparatus.

JAMES MILNE & SON,

GAS ENGINEERS,

Gas-Meter, Gas Apparatus, and Gas-Fittings Manufacturers,

EDINBURGH, AND

2, KING EDWARD STREET,

NEWGATE STREET, LONDON.

Meter Works in London—2, CROSS STREET, WILDERNESS ROW, E.C.

STATION-METERS GOVERNORS, CONSUMERS METERS, GAS LUSTRES, CHANDELIERS, BRACKETS, &c.,

And every description of Gas-Fittings and Gas Apparatus.

LONDONDERRY GAS COALS

DIRECT FROM THE

MARQUESS OF LONDONDERRY'S COLLIERIES.

COUNTY OF DURHAM.

For Prices and Particulars, apply to

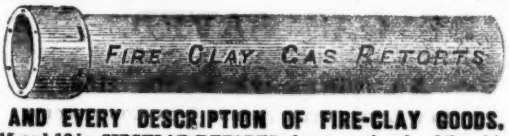
MR. S. J. DITCHFIELD,

LONDONDERRY OFFICES, SEAHAM HARBOUR, COUNTY OF DURHAM.

London Agents: Messrs. LAMBERT BROS., 85, GRACECHURCH ST., E.C.

JOHN HALL AND CO., STOURBRIDGE,

Manufacturers of FIRE-BRICKS, LUMPS, TILES,



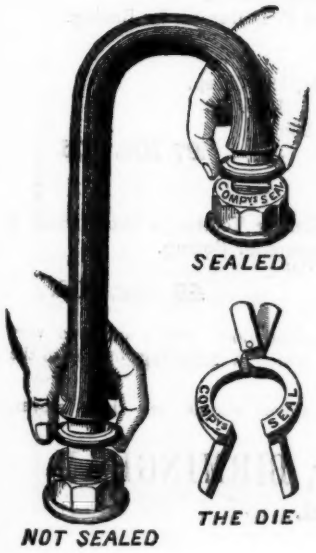
AND EVERY DESCRIPTION OF FIRE-CLAY GOODS.

N.B.—A Stock of 15 and 16 in. CIRCULAR RETORTS always on hand. Other kinds made to order on short Notice.

FOULGER'S PATENT

COUNTER-SUNK SEAL GAS-METER UNIONS,

As Supplied to The Gaslight and Coke Company.



These Unions practically place a Gas Company's property under lock and key, by rendering it impossible to disconnect at any joint at which gas could be obtained unregistered, without destroying the Company's seal or signature, whilst a small cover absolutely protects the impression from accidental injury.

A meter having been fixed with one of these Unions on the main-cock, and another on the inlet, a few pinches of specially prepared crushed sealing-wax is placed in the cup, and being melted with a blow-pipe, the wax runs between the reversed threads, the circular tong-shaped die will then give a sharp impression of the Gas Company's title, an operation requiring about two minutes in all to perform.

If heat is applied for the purpose of unsoldering the joints, the wax is instantly fused, and the impression, of course, lost.

Are supplied in all sizes, either as Caps and Linings or Barrel-Unions, and at a small additional cost over existing connections.

For further Particulars, Samples, &c., apply to the Sole Agents,

WIGGINS & RIHLL,

VICTORIA DOCK ROAD, LONDON, E.

C. & W. WALKER'S

WOOD PURIFIER SIEVES,

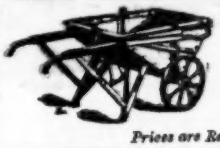
Which have now been used for fifteen years, and their advantages and durability fully established. They are made entirely by steam machinery in very large quantities at the most moderate cost.

MIDLAND IRON-WORKS,

DONNINGTON, NEAR NEWPORT, SHROPSHIRE.

FINSBURY CIRCUS, LONDON.

PRICE'S PATENT COKE & COAL BARROW



effecting a great saving of time, labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, Gas-Works, Hampton Wick, MIDDLESEX.

Prices are Reduced.

SCOTCH CANNEL COALS.

The Subscriber is prepared to contract for the supply of all the principal SCOTCH CANNEL COALS. Prices and Analyses of the various Coals will be forwarded on application.

JAMES M'KELVIE,

CANNEL COAL MERCHANT,

HAYMARKET, EDINBURGH.

Established 1840.

ESTABLISHED IN 1809.

BENJAMIN CARPENTER,

THE ORIGINAL MANUFACTURER OF THE IMPROVED

WOOD SIEVES

FOR

GAS PURIFIERS & SCRUBBERS.

PROVIDENCE WORKS,

22, HERMES STREET, PENTONVILLE ROAD,

LONDON, N.

The Dunston Engine Works Co.,

GATESHEAD-UPON-TYNE.

Are the Sole Manufacturers of

Archer's Patent Hoists,

ALSO OF

Archer's Patent Stone Breaker,

AND OF

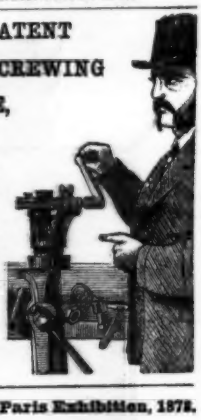
Archer's Patent Ore Crusher & Pulveriser,

The last-named Machine (without the Pulveriser) makes the best and most durable Coke Breaker.

GRIRDROD'S PATENT

PORTABLE PIPE SCREWING

MACHINE,



For 1 in., 1¼ in., 1½ in., and 2 in. Gas Threads, complete £7 10s.

In use at the chief gas-works, and giving great satisfaction.

For other useful goods, see Bailey's "Illustrated Inventions," post free 3s. 6d.; gratis to ledger customers.

W. H. BAILEY & CO.,

Brassfounders, Gauge Injector and Tool Makers,

ALBION WORKS, SALFORD,

LANCASHIRE.

Gold Medal Awarded, Paris Exhibition, 1878.

THOMAS TURTON AND SONS,

SHEAF AND SPRING WORKS,

SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS,

STEEL OF ALL DESCRIPTIONS,

SCREW STOCKS, TAPS, AND DIES, SPANNERS, RATCHET BRACES, LIFTING-JACKS, ANVILS, VICES,

AND ENGINEERS TOOLS GENERALLY.

LONDON OFFICE:

90, CANNON STREET, E.C.

AN ENGINE WHICH WORKS WITHOUT A BOILER OR STEAM

AVERAGE WEEKLY DELIVERY
(INCLUDING CONTINENTAL)
OVER TWENTY ENGINES.

The durability of these Engines is now established by experience, one of them having run night and day at the Hinckley Gas-Works for over Twelve months without any expenditure for repair; this being equal to about 2½ years average work.

Over 1900 already delivered.

Very numerous Testimonials from Users, including Engineers, Men of Science, and others, on application to the makers.

No trouble with Coal, Ashes, Smoke, Insurance, Water, or constant attendance.

No Glands to pack, or Water Gauges and Steam Gauges to watch.

STARTS AT A MOMENT'S NOTICE.

THE "OTTO" SILENT GAS-ENGINE.

(Otto and Crossley's Patents, 1876 and 1877,)

THEY ARE USED FOR ALL KINDS OF PURPOSES, CHIEFLY FOR EXHAUSTERS, SCRUBBERS, & PUMPS.

DELIVERED IN MANCHESTER. **SIZES** { NOMINAL HORSE POWER ½ 1 2 3½ 6 8 12 16 / MAXIMUM HORSE POWER ¾ 1½ 2½ 4 9 12 18 24 } **OFFERED.** CASES NOT CHARGED IF RETURNED FREE

PRICES INCLUDE CAST-IRON STAND, TURNED FLY-WHEEL, AND DRIVING PULLEY; WATER-VESSEL, SEVERAL DUPLICATES, AND GAS-FITTINGS (EXCEPTING METER AND PIPES).

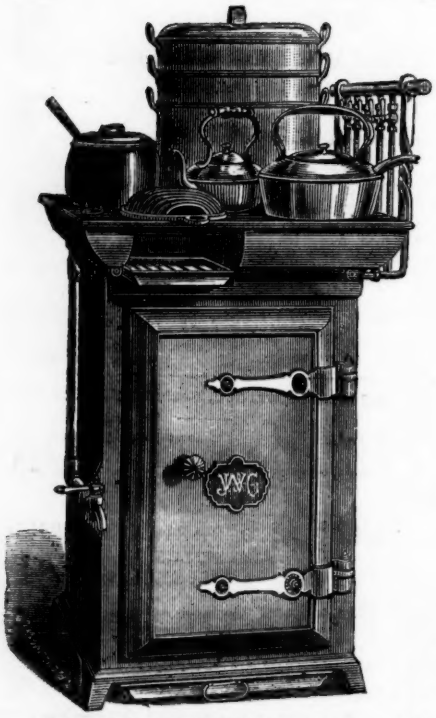
WORKS AND HEAD OFFICES: Gt. Marlbro' St., Gloster St.

CROSSLEY BROTHERS, MANCHESTER.

LONDON HOUSE: 116, Queen Victoria St., E.C.

THE NEW GAS COOKER.

40 PER CENT. OF GAS SAVED.



No. A510 same as our **No. A152,**
BUT LINED WITH PATENT NON-CONDUCTOR.
Will Roast, Bake, and Fry, and with Three Burners for Boiling.

SIZE.
Outside—30in. high, 20in. wide, 20in. deep.
Inside—19½in. „ 14in. „ 17in. „

Price . . . . . £4 14s. 6d.

No. A500.
LINED WITH PATENT NON-CONDUCTOR.
Is fitted with Roasting and Baking Oven and Four Burners for Boiling.

SIZE.
Outside—34in high, 20in. wide, 19in. deep.
Inside—30in. „ 16in. „ 17in. „
Hot Plate—24in. by 23in.

Price . . . . . £7 10s. 0d.

No. A505.
Same as with Roasting and Baking Oven, a Broiler or Toaster, a Chop Griller, a Hot Water Boiler, and Three Burners for Boiling.
Hot Plate—26in. by 24in.

Price . . . . . £9 15s. 0d.

These Cookers are jacketed, on the sides, top, and door, with a new and very efficient non-conducting material, by the use of which a **saving** of gas to the extent of **40 per cent.** is effected.

Gas Companies who are selling or hiring stoves should see these stoves. Catalogues and particulars on application to

JOHN WRIGHT & CO., ESSEX WORKS, BROAD STREET, BIRMINGHAM.

London Warehouses: { 155a, Upper Thames Street, 1, Little Bush Lane.

TANGYE BROTHERS AND HOLMAN,

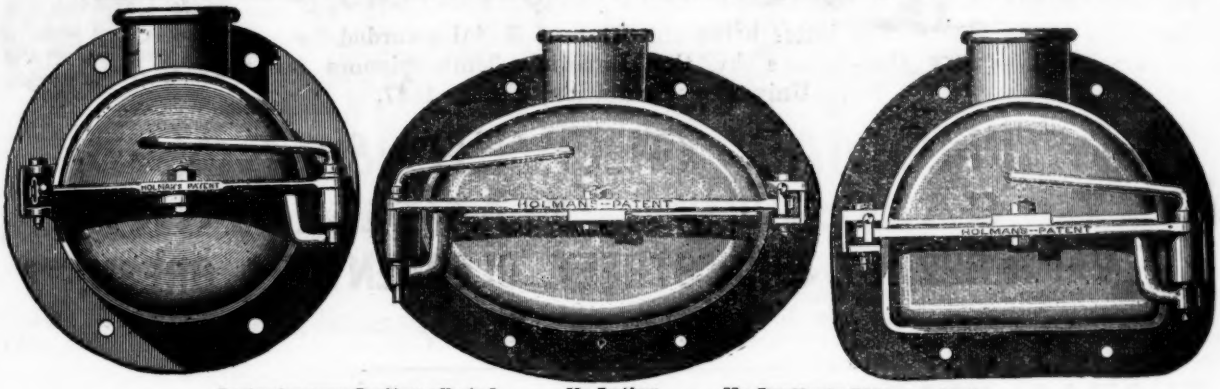
CORNWALL HOUSE, 35, QUEEN VICTORIA STREET, LONDON, E.C.,

(LATE OF 10, LAURENCE POUNTNEY LANE.)

SOLE MAKERS OF MORTON'S PATENT SELF-SEALING RETORT-LIDS,

WITH HOLMAN'S PATENT ECCENTRIC FASTENINGS,

Anti-Friction Catches, and New Self-Adjusting Cross-Bars.



Instantaneous Sealing effected. No Luting. No Duplicate Lids required.

Holman's New Self-Sustaining Cross-Bar ensures freedom of Joint, and maintains parallel position of the Lids.

Since their introduction in 1869, these Patent Retort-Lids have been thoroughly tested, being now in use in nearly all the principal Gas-Works in London and the Provinces.

T. B. and H. are now making the "Morton's Self-Sealing Lid" of the SAME FORM OR SECTION AS THE RETORT (see Illustrations above), as well as bringing the Mouthpiece from the D or Oval at back to Circular in front, as heretofore.

D and Oval Morton's Lids are working satisfactorily both in this country, on the Continent, and in the United States of America. Among others they have been adopted by the following Gas-Works:—

The Gaslight Company's Works, Fulham; Ditto, Bromley-by-Bow; Ditto, King's Cross; Ditto, Shoreditch.
And also in the Gas-Works at Richmond, Maidstone, Gloucester, Glasgow, Portsea, Roubaix (France), The Hague (Holland

HUNT'S PATENT EQUILIBRIUM GAS-GOVERNOR.

In this Governor a Throttle-Valve is substituted for the ordinary suspended Cone, all external communications being avoided by placing the Lever or Radius Arm (shown in the drawing) inside the Valve-Chamber upon the Disc. The Disc is carried upon steel centres, upon which it is accurately balanced and turns freely. The friction in working is thereby reduced to a minimum. This Governor is extremely sensitive to alterations of inlet or outlet pressure, and renders a large actuating holder unnecessary.

The principal advantages of this arrangement over the ordinary form of Governor are as follows:—

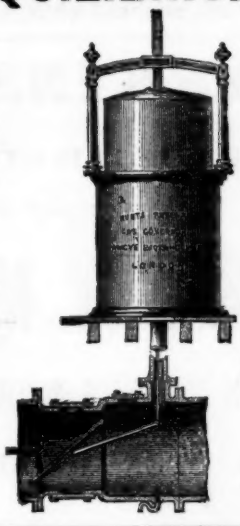
Its sensitive action prevents oscillation.

It is self-adjusting—*i.e.*, it maintains a steady pressure under variations of inlet pressure or a fluctuating consumption.

The inlet to Gasholder being contracted to the smallest possible dimensions, all danger from leakage through insufficiency of seal, tilting, &c., is entirely avoided.

The valve portion being separate from the holder, it can be handled and fixed like an ordinary Slide-Valve direct in the main; and the holder can be placed at an convenient distance immediately above it. The cost is thus materially reduced, and the inconvenience of heavy lifts done away with.

There are no working parts likely to get out of order.



These Governors have been adopted by many leading Gas Companies, among whom are the following:—

The Gaslight and Coke Co. (9), The London Gas Co. (3), and at Abergavenny, Arundel, Birmingham, Cannes (France), Devonport, Dursley, Exeter, Guernsey, Halesowen, Mentone (France), Monmouth, Newcastle-on-Tyne, Oxford, Plymouth, Rochdale, Windsor, &c.

TESTIMONIAL.

The Gaslight and Coke Company,
9, Water Street, New Bridge Street,
Blackfriars, E.C., Feb. 27, 1875.

MESSRS. TANGYE BROTHERS AND HOLMAN.

Gentlemen,—The two 24-inch and three 36-inch Hunt's Equilibrium Governors supplied by you, and fixed in the valve-rooms at Whitechapel, Goswell Road, and Blackfriars, are working very satisfactorily.

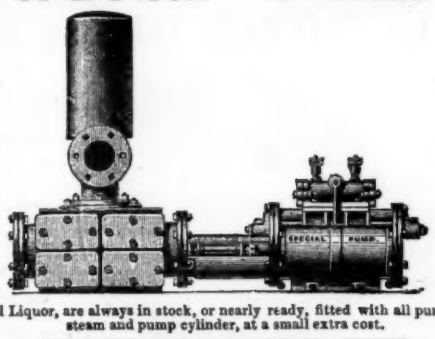
Yours truly,

(Signed) JOHN JOHNSON.

PRICES AND FULL PARTICULARS ON APPLICATION.

THE "SPECIAL" STEAM-PUMP.

Diameter of Steam Cylinder.	Diameter of Water Cylinder.	Length of Stroke.	Gallons of Water per Hour, Approximate.	Reduced Prices.
3	1¼	9	450	£16
4	2	9	815	18
5*	2¼	12	1,250*	21
5*	3	12	1,830*	22 10
4	4	12	3,250	25
6*	4	12	3,250*	30
5	5	12	5,070	32 10
7*	5	12	5,070*	40
6	6	12	7,330	40
8*	6	12	7,330*	50
7	7	12	9,750	50
10*	7	12	9,750*	65



In use in a Hundred Gas-Works in the United Kingdom for Pumping Ammoniacal Liquor, Water, or Tar.

Messrs. Burt, Boulton, and Haywood, Manufacturing Chemists, have over FORTY "Special" Steam-Pumps in use at their several large Tar-Works.

Two Hundred Sizes made. Those in Table opposite are the leading Sizes for use in Gas-Works and Chemical Works.

* These Sizes being usually selected for pumping Tar and Liquor, are always in stock, or nearly ready, fitted with all pump details in iron, and extra length distance-piece between steam and pump cylinder, at a small extra cost.

TANGYE'S HIGH-PRESSURE AND CONDENSING STEAM-ENGINES; CORNISH, VERTICAL, & TUBULAR BOILERS; HYDRAULIC AND SCREW LIFTING-JACKS, CRABS, PULLEY-BLOCKS, &c.

FULL PARTICULARS, ESTIMATES, CATALOGUES, ETC., ON APPLICATION.

London, 1851. New York. 1853. Paris, 1855. London. 1862.

Dublin, 1865.

The SIX MEDALS AWARDED to THOMAS GLOVER for

PATENT DRY GAS-METERS,

The latter being the Highest Medal awarded for Dry Gas-Meters by the Imperial Commissioners for the Universal Exhibition, Paris, 1867.

Paris, 1867.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

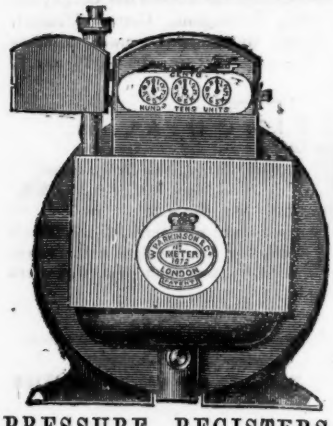
214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN,

LONDON, E.C.

THOMAS GLOVER & CO.'S PATENT DRY GAS-METERS.

1st, Are a remedy for all the defects of Wet Meters;
2nd, Are suitable for all climates, whether hot or cold;
3rd, Incur no loss of Gas by evaporation;
4th, Cannot become fixed by frost, however severe;
5th, Are the most accurate and unvarying measurers of Gas;
6th, Prevent jumping or unexpected extinction of the Lights;
7th, May be fixed either above or below the level of the Lights;
8th, Cannot be tampered with, without visibly damaging the outer case;
9th, Will last much longer than Wet Meters;
10th, Will not cost more than one-half for repair that Wet or Water Meters do;
Are upheld for five years without charge.

WILLIAM PARKINSON AND CO.,



(ESTABLISHED 1816,)

MANUFACTURERS OF

WET & DRY METERS,

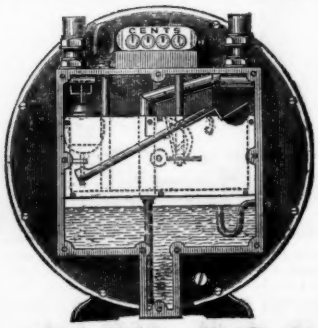
STATION-METERS & GOVERNORS,

EXHAUSTER REGULATORS,

PRESSURE REGISTERS, EXPERIMENTAL APPARATUS, GAUGES, WATER-METERS, &c.

HUNT'S PATENT IMPROVED COMPENSATING METER.

In this Meter, the action of the measuring-drum is reversed. By this arrangement an improvement is effected in the registration at high speeds, which, in many tests, has not varied from the smallest light to three times the capacity of the meter. It works equally well under all pressures. The range of error between the high and low line is much smaller than that allowed by the "Sale of Gas Act."



The Meter has been critically tested, and most favourably reported upon by official Meter Inspectors in London and Birmingham.

W. PARKINSON and CO. have made arrangements for the manufacture of these Meters, both in tin and cast-iron cases, and for the alteration of old ones to this principle, which is confidently recommended as possessing every quality that can be desired by Gas Companies, Corporations, or Private Consumers.

COTTAGE LANE, CITY ROAD, LONDON, E.C.

CONTENTS.

	Page
Circular to Gas Companies:—	
Gas Companies and the Electric Light	209
Third Reading of the Liverpool Lighting Bill in the House of Lords	209
The Preston Gas Company and the Corporation	209
Half-Yearly Meeting of the Cambridge University and Town Gaslight Company	209
Annual Meeting of the Reigate Gas Company, Limited	209
Birmingham Corporation Gas Supply	209
North British Association of Gas Managers	210
Water and Sanitary Notes:—	
The Water Supply of Liverpool	210
Agitation on the Metropolitan Water Question	210
Mr. Rowbotham on the Supply of Water to London	210
Correspondence:—	
The Elimination of Sulphur Compounds from Illuminating Gas	211
The Report on the Experiments with the Electric Light on the Thames Embankment	212
Gas Distributors	212
A Distinguishing Mark for Gas Officials	212
The Pumping of Tar	212
Parliamentary Intelligence:—	
Progress of Bills in House of Lords	212
Progress of Bills in House of Commons	212
Gas Companies and the Electric Light	212
Legal Intelligence:—	
High Court of Justice—Chancery Division—*In re* The Cadiz Water-Works Company	213
Staffordshire Summer Assizes—Tatton *v.* The Staffordshire Potteries Water-Works Company	213
Miscellaneous News:—	
Society of Engineers	212
Association of Municipal and Sanitary Engineers and Surveyors	212
Metropolis Water Supply	214
Reduction in the Price of Gas at Whitehaven	214
Meeting of the Cambridge University and Town Gaslight Company	214
Meeting of the Walton-on-Thames Gas Company	215
Reduction in the Price of Gas at Uttoxeter	215
Meeting of the Reigate Gas Company	215
The Weardale and Shildon Water Company and the Water Supply of Durham	215
Peebles's Patent Metallic Needle Governor	215
Birmingham Corporation Water-Works	216
Presentation to Mr. W. Daley, of Invercargill, New Zealand	216
Midland Association of Gas Managers	216
St. John's Gas Company	218
Fatal Fire through an Alleged Escape of Gas	218
Warrington Corporation Gas Supply	218
Analyses of the Waters of Lake Thirlmere and the River Vyrnwy, the New Sources of Water Supply for Manchester and Liverpool. By Mr. C. Estcourt, F.C.S.	218
The Preston Gas Company's Bill	218
North British Association of Gas Managers	219
Taunton Gas Company	223
The Electric Arc: Its Resistance and Illuminating Power. By Elihu Thomson and Edwin J. Houston	223
City of Norwich Water-Works Company	223
Trade Reports	224
Reduction in the Price of Gas at Newton-le-Willows	224
Sulphate of Ammonia Plant	224
Extension of Storeage at the Ramsgate Gas-Works	224
The Gas Supply of New York	225
Register of Patents:—	
Boag, J. D.—Manufacture of Gas	225
Wirth, F.—Purifying Water	225
Benson, M.—Pipe Joints	225
Gent, J. S.—Gas Burners	225
Voisin, A.—Lighting Gas Lamps by Electricity	225
Clark, A. M.—Hydraulic Limes and Cements	225
Hilton, M.—Manufacture of Gas	226
Proud, T.—Purification of Gas	226
Applications for Letters Patent	227
Patents which have passed the Great Seal	227
Share List of Gas and Water Companies	226

TO CORRESPONDENTS.

ENQUIRER.—*The duty of the district surveyor is to report to his board, who may, if they think fit, take what legal proceedings may be advised; but the Company having enjoyed the privilege of opening the streets for the last 39 years, it is not at all likely that any Court of Equity would interfere to prevent the continuance of that privilege, always supposing that the operations are carried on so as to cause the smallest possible inconvenience to the public. We have often said that it is very advisable for Gas Companies to clothe themselves with parliamentary powers, which may now be cheaply obtained by means of a Provisional Order from the Board of Trade, or (if unopposed) by a Bill in Parliament.*

THE JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, AUGUST 5, 1879.

Circular to Gas Companies.

IT is extraordinary to notice the opposition shown to Gas Companies as regards their obtaining powers to supply the electric light. It would be difficult to explain the reasons for this antagonism but for the statements made by Mr. D. Chadwick in the House of Commons on the 29th ult. This gentleman argues that every additional privilege granted to a Company will enhance the value of their undertaking when a question of purchase by a Local Authority is considered. We shall not attempt to controvert this argument; still it appears to us to tell nothing against the right of a Gas Company to possess the privilege. As matters stand at present, the day appears distant when the electric light will become a thing of profit to either Gas Companies or Corporations. It might, therefore, have been safely left for time to settle the relative positions of those bodies. But as the Committee on Lighting by Electricity decided that Gas Companies should not possess the exclusive right of supplying the electric light, we must accept our position with the satisfaction of thinking that our interests are not at all interfered with by the refusal. Local Authorities are perfectly welcome to expend the ratepayers money in making experiments with the electric light, which, for the most part, will prove abortive. Gas Companies may, therefore, patiently wait, and quietly pursue an industry which, with careful management, is always profitable, and capable of development as their district extends. There is, then, in our opinion, no reason to regret the decision of the Committee of the House of Commons; on the contrary, we think Gas Companies may be congratulated on the result.

The Liverpool Lighting Bill has now passed the third reading, and will, no doubt, receive the Royal Assent this week. All Town Councils are now up for the holidays, and we do not suppose that we shall hear until next year what steps the Liverpool Council intend to take to carry out the exceptional powers they have obtained.

The Preston Corporation are angry with the Gas Company for remunerating the Directors for their labours in preparing and seeing through Parliament their Act of the present session. The Corporation, it is said, spent between £1000 and £2000 in opposing the Bill, and no doubt a part of this sum went—not, it is true, into the pockets of some of the Council, but to the advantage of some of them. Of course, the Council have no power to vote themselves any money reward for the labours they perform, but they ought not, on this account, to envy the Gas Directors the remuneration which the Shareholders have awarded them. Matters of this kind are a constant source of squabbling between Local Authorities and Companies. The former look with a jealous eye upon every appropriation of profits which is not made to the direct advantage of the consumers. In the long run, however, we think it will be found that the Preston Gas Act will operate favourably to the interest of the public. Some members of the Corporation threaten an attempt to make a compulsory purchase of the Gas Company. They will find this a difficult and very expensive process, and if they should succeed, the troubles of the Council will only be begun. It must be admitted that Preston is extremely well served with gas at a very moderate price, and nothing but forbearance and courtesy are required to establish relations which would prove beneficial to both parties. Nothing is to be gained by violent opposition on the one side, and dogged resistance on the other. Let each party approach the other in a friendly spirit, and gas squabbles will cease in Preston.

The half-yearly meeting of the Cambridge University and Town Gaslight Company was held on Thursday last. It is hardly necessary to say that the Company are still in a highly prosperous condition. The revenue account shows a large excess of income over expenditure, and, considering the prospect of a continuance of cheap coal, the Directors have resolved to reduce the price of gas threepence per thousand feet from Midsummer last. While having regard to the consumers interests, the Directors are not unmindful of their duty to those Shareholders who invested their money when it was less productive than it is to-day, and they accordingly set aside 10 per cent. for the payment of back dividends to the proprietors of consolidated stock. It ought always to be remembered that the first Shareholders had to bear the burden and heat of the day. They obtained but little for their investment, and now that times are become more propitious they deserve to be rewarded for the sacrifices they made in earlier days. At the meeting a doubt was expressed by a Shareholder not interested in the latter distribution, as to the legality of the payment; but we may assure him that there is no doubt whatever about the matter. The Directors have not only the right, but, in some respects, it is a duty to allot unappropriated balances for the payment of back dividends. We miss on this occasion one of those admirable speeches with which the Chairman so commonly gratifies the whole gas world. There is, however, no "burning topic" on which to expend his eloquence, and, with some regret, we wait for an occasion which may once more induce him to speak.

The annual meeting of the Reigate Gas Company, Limited, was held last Thursday. In a thriving and rapidly improving district like that occupied by this Company, it is not surprising that a high degree of prosperity should be enjoyed. It appears that from the workings of the past year a dividend of 15 per cent. might have been paid; but although a limited Company, who could pay what divided they pleased, they keep back some of the profit for the benefit of the consumers, and make a reduction in the price of gas. The Company pay 10 per cent. dividend, and put £300 to the contingency-fund, carrying forward £201 to the next account.

We omitted last week to remark upon the half year's working of the gas undertaking of the Birmingham Corpora-

tion. That the works in the hands of the Corporation have been eminently successful, our readers well know; but the report which we published in the last number of the JOURNAL shows that they have been more successful than people would generally anticipate. The increase in the sale of gas over that of the corresponding half year of 1878 is nearly 10 per cent.; but the indices of the meters were taken early, or else the increase would have practically amounted to as much as 12 per cent.

We will stop here for a moment to point out the possibility that the Corporation, in the corresponding half of next year, will be accused of malpractices in exaggerating their gas accounts, unless the indices of the meters be taken at the same date. This irregularity in making-up the gas accounts to uncertain dates is, we fear, a common source of complaint. The consumer looks at his gas bill broadly as a quarterly account. He does not know, or pays no attention to the date at which the meter index was taken. Thus a quarter's consumption may sometimes appear large, sometimes small, and dissatisfaction is often expressed at the fact. It is clear that there is here a disturbing element, which may, in the minds of consumers, excite distrust. The Chartered Company do their best, by leaving cards showing the state of the indices on the day of examination, so that any consumer can see for himself whether his quarter was long or short, and so far estimate whether or not his consumption was within the usual limits.

But to return to Birmingham. We shall add nothing here to what we have already said about the Birmingham Gas Act. In our opinion, the Corporation will have nothing to complain of, when the differential rates are abolished. It may be an unpleasant fact, that the consumption in Yardley per mile of main is much less than at Solihull, much more distant from the works; but this is one of the common incidents of gas supply. If a charge for gas is to be made in proportion to the rate of consumption per mile of main, we shall be landed in several difficulties. In the first place, a crowded district will ask for a supply at a very low rate, and the more distant one, on a less-used main, will object to pay any differential rate. In the charges for gas there can only be one rule, such as is acknowledged in the Metropolis. We do not, of course, find fault with the discounts allowed by Provincial Corporations; but the principle is bad. All consumers, large or small, should be charged at the same rate for gas, just as they are for other necessaries.

We are happy to see the employment of apparatuses for the use of gas, for other than illuminating purposes, extending in Birmingham. It is to be hoped that the Corporation are now reaping the benefit of their interesting exhibition, the usefulness of which will, in all probability, continue to be more extensively felt. It is needless to say that the quality of the gas supplied by the Corporation is well maintained. With such a Committee and such Managers, nothing less could be expected. It is gratifying to see that the sale of coke increases in Birmingham. It speaks of two things—first, that a most economical and useful fuel is better appreciated; and next, that the material prosperity of the borough and neighbourhood is increasing.

We continue to-day our report of the proceedings of the North British Association of Gas Managers, and publish Mr. D. Bruce Peebles's account of his needle governor. It has been so long and so thoroughly established that the amount of light to be derived from the combustion of coal gas is altogether dependent on the pressure at the point of combustion, that we are almost astonished that pains should be taken to establish the fact. That the maximum amount of luminosity is to be obtained at the point at which the flame commences to smoke, has been known, we believe, ever since the time of Sir Humphry Davy, who also demonstrated the fact that the luminosity of a flame is dependent upon incandescent carbon. Nevertheless, this discussion at Edinburgh was not without its value. There is, however, this cardinal fact to be remembered—that gases of different qualities must be consumed at different pressures in order to evolve the maximum luminosity of a flame. Broadly, it may be put that a low pressure answers well for all; but a low pressure for a 28-candle gas and a low pressure for a 16-candle gas may possibly mean two different things. In the one case, the unconsumed carbon is likely to be deposited on the ceilings, if the pressure be too low; and in the case of poor gas, it is perhaps impossible for the pressure to be too low.

We shall defer our notice of Mr. Young's paper, "On the "Proportion of Carbon present in Gas in relation to its "Illuminating Power," till next week, when we hope to finish the publication of the report of the proceedings at the meeting.

Water and Sanitary Notes.

OUR readers know that for a few years past—we do not exactly remember for how many—the Town Council of Liverpool have been laboriously occupied in the consideration of a variety of schemes for furnishing an additional supply of water to their borough and neighbourhood—a supply which, we are bound to say, will soon be much needed. To begin at home, they have had the scheme so persistently advocated by Alderman Bennett, of extending the well supply. As regards this, we need only say that the experiments made have failed to demonstrate that any considerable additional supply was to be derived from this source. To enumerate the other schemes which have been brought before the Council would be almost beside our purpose; but we may just mention that one proposed to take a supply from Windermere Lake; another from Haweswater, which has been greatly favoured by some members of the Town Council; and a third was to share with the Corporation of Manchester in the supply of water which that Corporation are about to bring from Lake Thirlmere, the aqueduct to convey which will pass within a short distance of the Rivington reservoirs of the Liverpool Corporation. Last, but most important of all for our present purpose, comes the scheme for taking a supply from the head waters of the Severn—known as the Vyrnwy scheme, on account of this river furnishing the largest quota to the forty million gallons of water which it is calculated may at once be taken to Liverpool daily. This is the scheme which found most favour with a considerable majority of the Town Council, who, on Tuesday last, decided to adopt it, and take steps to promote a Bill in Parliament to carry it into effect. What these steps are, our readers very well know. There is to be a second meeting of the Council, at which an absolute majority must decide on the promotion of the measure. There is then the town's meeting under the Borough Funds Act, 1872. Now, the Town Council of Liverpool have had some adverse experience with these meetings, but we cannot think that the ratepayers will object to the outlay which will be incurred in the promotion of the Vyrnwy scheme. It is true they may be heavy, for it is quite possible that strong opposition will be raised by the proprietors of water rights at the head of the Severn, who will, of course, demand heavy sums for compensation.

It is impossible for us to publish the discussion that took place in the Council, which showed, in effect, that there was little difference in the quality of the water furnished from Haweswater and from the Vyrnwy. Dr. Frankland seems explicit on this point, and his word must be taken as conclusive. As regards the cost of what we may call the rival schemes, the advantage appears to lie with the Vyrnwy; but even in this case the expenditure will necessarily be large. The ratepayers of Liverpool will have the relative merits of the schemes laid before them shortly, and they must make their choice. To divide with Manchester in the supply from Thirlmere would, of course, be cheaper; but the second town in the empire could not condescend to share even with such an important city as Manchester.

Metropolitan water affairs will occupy much public attention in the course of the present week. On Thursday evening Mr. Fawcett is to draw the attention of the House of Commons to the present condition of the water supply of the Metropolis, and to-morrow evening the working men of London are invited to meet Cardinal Manning and other enthusiastic water drinkers at Exeter Hall, "to urge upon the "Government the necessity of procuring powers by Act of "Parliament to provide the Metropolis with a constant supply "of pure water, direct from the source, under the administra-"tion of a Metropolitan Authority."

Mr. Rowbotham* is endeavouring to revive an old—we might almost say an exploded idea. It will be remembered that in 1865 Mr. Bateman proposed to supply London from the top waters of the River Severn. The notion obtained some popular support, but although the scheme was admittedly quite feasible, the Duke of Richmond's Commission condemned it, mainly on the ground that the basin of the Thames was capable of furnishing a sufficient quantity of water to supply the wants of the Metropolis for generations to come. Since the publication, in 1869, of the report of the Commission of 1866, Mr. Bateman's plan has been almost forgotten. The source is undoubtedly an excellent one; the supply of water ample to furnish the inhabitants of London, at any reasonable rate of increase, for ages to come; and the engineering difficulties, if they may be so called,

* "Metropolis Water Supply. On the Supply of Water to London." By Geo. A. Rowbotham. Printed for private circulation. 1879.

in the way of bringing it to the Metropolis were not insuperable. Nor could the cost of the scheme, as estimated, be regarded as extravagant. London could very well afford to spend £5,440,000 on a new water supply if it were needed; but, as a matter of fact, none is wanted. All that is necessary is to develop our present sources as required for the growing wants of an ever-increasing population. But Mr. Rowbotham has overlooked one fact, which at this moment deserves notice. The head waters of the Severn, as our readers will note above, are about to be appropriated for the supply of Liverpool—that is, if the ratepayers consent. Thus, Mr. Rowbotham's revived scheme falls to the ground; and we are not at all sorry, for we greatly prefer Thames water to the peaty infusion which will be derived from the Welsh hills.

Correspondence.

[We do not hold ourselves responsible for the opinions expressed by Correspondents.]

THE ELIMINATION OF SULPHUR COMPOUNDS FROM ILLUMINATING GAS.

SIR,—Accept my best thanks for the notice which you have so kindly taken of the paper on the elimination of sulphur compounds from coal gas which I had the honour of reading before the North British Association of Gas Managers, and for the recommendation which you have so warmly given your southern readers to test the matter for themselves. They are far more interested than Scotch managers, and I do hope that they will make such experiments as shall satisfy them of the soundness of the process. I shall be glad to send them samples of the fluid with which to experiment, trusting that they will communicate through your valuable pages the results which they may obtain.

I have frequently regretted the want of language sufficiently explicit to convey my meaning or thoughts when addressing others, and in this case I regret exceedingly to find that I have not made sufficiently intelligible the application of this hydrocarbon fluid (recovered from waste shale gases) to the elimination of sulphur compounds; for, both from your notice and from the remarks of others who have since spoken to me on the subject, it seems to be considered somewhat anomalous that a volatile hydrocarbon fluid can be employed both as a carburetting agent and also for the elimination from coal gas of another volatile compound such as the sulphide of carbon, and that the natural inference would be that both would ultimately find their way together into the gas.

I observe, further, that I also appear to have failed to convey my true meaning when speaking of the use of this fluid in conjunction with lime and other salts having an affinity for sulphide of carbon; but, with your kind permission, I shall try again, and endeavour to make myself better understood.

And to illustrate my subject, I shall deal with matters with which we are all already conversant. Suppose we had perfectly dry air containing a proportion of dry ammoniacal gas diffused through it, we could remove every trace of such ammonia by passing it through a series of washers or scrubbers through which a current of water is made to flow—that is, on entering the first vessel containing water, the ammonia would be at once partially absorbed, but at the same time the dry air would take up in diffusion a portion of watery vapour, and at each succeeding vessel the ammonia would be further absorbed and the air further moistened, till by the time the air issued from the final vessel it would not contain a trace of ammoniacal gas, but would be fully saturated with watery vapour. Here we have a substance with a far higher tension, or, in other words, far more volatile than sulphide of carbon, being absorbed by a volatile fluid which at ordinary temperatures would supply nearly 2 per cent. of its vapour to the dry air. No doubt this absorbent action of the water is limited, and therefore unless the water were renewed the air would pass, becoming saturated with moisture, and retaining the greater portion of the ammonia which it originally contained; but long before such could be the case, the first vessel would contain a very strong solution of ammonia, and we know that we could remove the water before the point of saturation with ammonia was nearly attained, and by simply heating the ammonia solution in a still, the ammonia would be driven out, and the pure water left behind could be cooled and returned to the finishing vessel of the washer or scrubber.

Now, suppose we employed this fluid hydrocarbon to recover bisulphide of carbon or other sulphur compounds from coal gas—and for the sake of simplicity we shall suppose that this fluid has the same boiling point as water, and is supplied to the gas in a similar way—it is evident that the gas containing the sulphur compounds, on entering the first vessel, would have a portion of those sulphur compounds removed by being absorbed by the fluid; but, at the same time, a portion of the vapours of the fluid would be diffused through the gas, and at each succeeding vessel the sulphur compounds would be further absorbed, until finally they would be entirely removed. At the same time, the gas would have a further and further quantity of the vapour of the fluid diffused through it, until being saturated, when it would contain a percentage of the vapour of the fluid equal to that which the air contained of the water, or nearly 2 per cent. This 2 per cent. or so of hydrocarbon vapour derived from the fluid, diffused through the gas, would very considerably increase its illuminating power. Long before the fluid in the final wash vessel would allow sulphur compounds to pass, the fluid in the first vessel would be so saturated that, as in the case of the watery solution of ammonia, they could be separated by fractional distillation, or by subjecting the vapours of the distillate to heat in the presence of steam, when the sulphur compounds would be broken up, and sulphuretted hydrogen gas liberated; or they could be treated chemically, which would be the simplest and most perfect way for their removal. The fluid so freed from sulphur compounds could be returned to the final wash vessel to complete the operation of removing the sulphur compounds from the gas.

I hope those remarks have shown how this fluid can be employed as a simple solvent for the sulphur compounds present in coal gas. Let me now take a similar mode of explaining the application of this fluid in conjunction with chemicals having an affinity for sulphide of carbon.

Suppose that ordinary crude gas contains carbonic acid, and sulphuretted hydrogen was perfectly dry on entering the ordinary moist lime purifiers. At the instant of the first contact between the wet lime and the dry gases, the water would at once absorb a portion of the two acid gases CO_2 and H_2S, reducing them to the liquid form, and thus bring them into such close contact with the lime that chemical action would result, and CaO CO_2 and CaS H_2S would be formed. At the same time the gas would take up in diffusion a portion of the water from the lime, and at each succeeding contact between the gases and the wet lime a further quantity of acid gases would be absorbed, and a further quantity of watery vapour diffused through the gas, till by the time it reaches the outlet from the purifiers, every trace of the acid gases would be removed, but the gas would be saturated with the vapour from the wet lime.

Now, as you are aware, the chemical substances which are employed with most advantage for the removal from coal gas of the sulphide of carbon are the alkalies or alkaline earths, not in a caustic state, but in the form of the hydrosulphides. Dr. Odling has shown that between perfectly dry solid hydrosulphide—say, of lime—and the sulphide of carbon diffused through coal gas, there is but a feeble affinity; that union takes place very slowly; and, consequently, the purifying material must be kept for a long time in contact with the gas, due to the fact that a dry gas and a dry solid chemical, although possessing great affinity, are not brought into sufficiently intimate contact without the intervention of a substance which will reduce the gas to a liquid form; but he shows that the wetting of the lime salt with water does not only not increase the rate of union, but that, in point of fact, it rather retards it, because the sulphide of carbon is insoluble in water, and is, therefore, not absorbed and brought into intimate contact with the lime salt, as is the case with water and carbonic and hydrosulphuric acids when caustic lime is employed for their removal.

But let us now suppose that, instead of wetting the dry hydrosulphide of lime CaS H_2S with H_2O, we wet it with the hydrocarbon fluid recovered from the waste shale gases, which may be represented by C_nH_m: this fluid, as you admit, would at once absorb the hydrosulphide of carbon from the gas. It would therefore reduce it to the liquid form, and, of course, bring it into intimate contact with the hydrosulphide of lime, with which it would immediately combine, leaving the hydrocarbon free to absorb a fresh quantity of sulphide of carbon vapours, or, if sufficiently volatile, would volatilize into the gas, to carburet it in exchange for the sulphide of carbon removed. Or the analogy between the action of the absorbents, water and the hydrocarbon fluid, may be graphically shown as under:—

When CO_2 is removed from the Gas.

First Stage. —CaO, H_2O + H_2O + gaseous CO_2.

Second ditto.—CaO, H_2O + $\left\{\begin{matrix}H_2O\\CO_2\end{matrix}\right\}$ liquid.

Third ditto. —CaO, CO_2 + H_2O, H_2O.

When CS_2 is removed from the Gas.

First Stage. —CaS, H_2S + C_nH_m + gaseous CS_2.

Second ditto.—CaS, H_2S + $\left\{\begin{matrix}C_nH_m\\CS_2\end{matrix}\right\}$ liquid.

Third ditto. —CaS, CS_2 + H_2S + C_nH_m.

You will remember that it was at one time proposed to use sulphur as a material to combine with and remove the sulphide of carbon from coal gas; but it was shown that sulphur could not have any such solvent action for the sulphide of carbon present in coal gas, otherwise the finely-divided sulphur set free in the employment of the hydrated oxide of iron for the removal of sulphuretted hydrogen from the gas would have removed the other sulphur compounds as well; and Dr. Odling shows that, although liquid sulphide of carbon and sulphur are solvents for each other, it does not follow that sulphur is a solvent for sulphide of carbon in the gaseous form. This is another proof that in many cases it is necessary to reduce a gas to the liquid form before it can combine with a solid, either chemically or dissolved. Now, suppose the hydrated oxide of iron, holding diffused through it 30 to 40 per cent. of finely-divided sulphur, were to be wetted with this hydrocarbon fluid, it is evident that the sulphide of carbon present in coal gas in the gaseous form would be reduced to a liquid state by being dissolved by the fluid; but no sooner would the sulphide of carbon be reduced to the liquid form than it would be partially dissolved out of the fluid by the sulphur, and thus the sulphur would be made a solvent for the sulphide of carbon present in the coal gas, but through the medium of this fluid. Of course, this interchange of affinity would be principally effected in the lower layers of the purifying material, and the sulphur compound would be thus principally transferred to the sulphur. The hydrocarbon fluid, therefore, wetting the upper layer of the purifying material, would be diffused through the gas, and would very much improve its illuminating power, and at the same time the sulphur compounds would be removed.

Now, I think it will be sufficiently plain that illuminating gases may be freed from sulphur compounds and carburetted by the same fluid employed to remove those compounds from the gases. On entering the purifier charged with the chemicals moistened with this fluid hydrocarbon, the sulphide of carbon would be immediately absorbed and reduced to the liquid form, and chemically combined with the lime salt or other material, the hydrocarbon being set free either to be diffused through the gas, or to absorb a further quantity of sulphur compounds from the gas. This action, at each successive contact between the gases and the lime salt or other material wetted with the hydrocarbon fluid, would be repeated till the sulphur compounds were completely removed and the gases saturated with the vapours of the hydrocarbon fluid, which would be in proportion to the volatility of the fluid employed, and the temperature at which it was used.

I have taken no notice of the action between this hydrocarbon fluid and the hydrocarbon vapours usually diffused through the gas, as it would only tend to confuse matters, and at any rate they are of no

practical importance, as they soon balance themselves when the action ceases; neither have I referred to other modes of applying this liquid, such as the substitution of the corresponding ammonia and soda salts for the lime, as the instances which I have here given are typical, and, as far as I can see, the best to illustrate this matter.

WM. YOUNG.

Clippens Oil-Works, by Paisley, July 31, 1879.

THE REPORT ON THE EXPERIMENTS WITH THE ELECTRIC LIGHT ON THE THAMES EMBANKMENT.

SIR,—As you have published the text of Messrs. Bazalgette and Keates's report on the electric light, I shall feel obliged if you will permit me to point out a contradiction in that report which is likely seriously to mislead the public, and which indeed entirely destroys the value of the calculations respecting the relative cost of gas and the electric light.

After stating truly "that Mr. Sugg's experiments with large-sized burners afford the best means of comparison as to the cost of the electric light and gas," they proceed to tell us that "to produce a light of 155 candles, *in one of the large Sugg burners*, about 48 cubic feet of gas per hour must be consumed. To produce a light equal to 265 candles, it would require about 83 cubic feet per hour;" and they then add: "This is calculating the value of the gas at 16 candles per 5 cubic feet, and making no allowance for the advantages which Mr. Sugg shows to accrue from burning the gas in large quantities together."

How can these two statements be reconciled? Would not any one suppose that the difference in value was so slight as not to be worth attention? But what is the fact? Having experimented largely with Mr. Sugg's large burners, I find that when 57 cubic feet of 16-candle gas are consumed in it (about the largest quantity it burns well), the light is equal to 270 candles, or 5 candles more than the estimated light of the electric lights in the frosted globe. The cost, therefore, instead of being 3·5d. per hour for 265 candles, would be 2·39d. per hour for 270 candles, or more than 1d. less than is stated in the report. What the precise quantity of gas required to produce a light equal to 155 candles would be I cannot say, as no burner has, to my knowledge, been constructed which is calculated to give this amount of light; but as the so-called 80-candle burner consumes something less than 20 cubic feet per hour, we can judge pretty well that if a burner were constructed to give a light of 155 candles its consumption would not be 48 cubic feet.

I trust that when we have the report of the more extended experiments on the Embankment, its value, which no one appreciates more than myself, will not be lessened by such an error.

CHARLES HEISCH, F.C.S., &c.

City Gas Examiner's Office, Laboratory, 79, *Mark Lane, E.C., Aug.* 1, 1879.

GAS DISTRIBUTORS.

SIR,—On looking over the pages of your last JOURNAL, I was much encouraged to find that so great an authority as Mr. J. O. N. Rutter should have proved, and so well described the practical value of an apparatus which he terms a "distributor" or "refrigerator," because I have at the Lewes Gas-Works an apparatus on the same principle, which has been at work satisfactorily for nearly four years. We have used it in connection with the liquid ammonia gas purification process, chiefly for the extraction of tarry and condensable matters at the outlet of the condensing-pipes, and it has done its work well. I arranged it in a very simple form, and included it in my patent, No. 2376, June 14, 1878, *vide* figs. 6 and 7.

I do not think it necessary, as proposed by Mr. Rutter, to provide separate rectangular boxes with the gratings fixed horizontally in each alternate box, because the grating-bars work much cleaner and better in a vertical position, and the bars or gratings may be so arranged as to break up the gas in thin streams. There may be any number of gratings in one box, and the box fixed at that point in the gas plant where it is most useful, and not at all likely to stop up with tar. Thin hoop iron I have found to be much more effective than round rods. I have also made provision, by means of liquid, to regulate the speed of the gases through the grating, according to temperature, time of year, and make of gas, the liquid also serving as a self-acting bye-pass for the gas in case of need.

I believe every gas-works, large and small alike, could add the above apparatus to their ordinary gas plant with beneficial results.

JOHN HAMMOND.

Lewes, July 31, 1879.

A DISTINGUISHING MARK FOR GAS OFFICIALS.

SIR,—Your remarks on "A Distinguishing Mark for Gas Officials" have attracted my attention, and, as some time ago I had considerable difficulty on account of light-fingered gentlemen getting into respectable houses here, under the pretence of being connected with this Company, it may not be out of place for me just to say that I entirely got over the difficulty by simply supplying my men with a good cloth cap, mounted with a conspicuous band round it, on which was marked in plain lettering, "Hastings and St. Leonards Gas Company." I insisted on the men wearing this badge whenever about town on the Company's business, and have never had any trouble since with "shams."

You say to put men in livery would be a little expensive. The total cost in my case is only 6s. 6d. per man per annum.

A. H. WOOD.

Gas-Works, Hastings, July 31, 1879.

THE PUMPING OF TAR.

SIR,—In reply to "B. A. T.," in the last number of the JOURNAL, I have found a Tangye's steam-pump answer admirably for a similar purpose. It should have the steam cylinder twice the diameter of the pump-barrel—say 5-inch by 2½-inch. With this size I can fill a tank holding 2400 gallons of water in two hours. Tar takes a little longer, but would be well within the time mentioned by "B. A. T." It will be found an advantage to have the delivery-pipe of large calibre—2½ or 3 inches—for so great a distance as 200 yards.

I should add that the steam-pump, being independent of the engine, may be fixed in the most convenient place near the tar reservoir. Mine is fixed on brackets against the wall of the retort-house, and the supply of steam is brought nearly 50 yards. It has been at work over two years without giving the least trouble.

STEAM-PUMP.

July 30, 1879.

SIR,—In reply to "B. A. T.," I would advise him to get one of Cameron's double-action ram pumps. I have been using one for the last eighteen months for pumping and forcing tar some distance, and also for pumping gas liquor through the scrubber. They are strong pumps, and not likely to get out of order. I should say a 3-inch pump would be sufficient for his purpose, with a 2-inch pipe for the inlet and outlet.

R. L. ROBINSON.

Gas and Water Works Office, Kendal, Aug. 4, 1879.

Parliamentary Intelligence.

HOUSE OF LORDS.

TUESDAY, JULY 29.

Knutsford Light and Water Bill,—reported, with amendments.

Liverpool Lighting Bill,—read the third time, with the amendments, and passed.

FRIDAY, AUG. 1.

Derby Improvement Bill,—reported, with amendments.

HOUSE OF COMMONS.

TUESDAY, JULY 29.

GAS COMPANIES AND THE ELECTRIC LIGHT.

Mr. CHADWICK asked the Chairman of Ways and Means whether, in any private Bills passed this session, the monopoly and powers of any gas companies in regard to gas had been extended to electric lighting, so as to give the companies, in case of their undertakings being purchased by any public bodies, a claim to be paid for any such extra privilege or monopoly; and whether he would report to the House before any such extension of monopoly rights was allowed in any private Bill, whether opposed in Committee or otherwise.

Mr. RAIKES said the question was one of some importance with regard to the measures which had been introduced in the House during the present session by various public bodies, with the view of obtaining powers to use the electric light. Altogether as many as 35 such Bills had been introduced. A Select Committee was appointed to consider the question of lighting by electricity, and he stipulated with the promoters that in the event of their Bills being allowed to go forward all the clauses which related to electric lighting should be struck out; but that if the Committee reported in favour of such powers being given to the promoters of such undertakings, the clauses should be re-introduced at a subsequent stage. The Committee having reported adversely to the extension of such powers to gas companies, those companies were not allowed to insert clauses relating to the electric light in any of the Bills promoted by them; but it had been open to corporations to adopt such clauses as might be found to correspond with the recommendations of the Committee, and in three or four cases they had done so. In no case, however, was power given to a gas company to make use of the electric light. With regard to the second part of the question, he did not think it would be in accordance with precedent to make a formal report to the House of the cases in which the extension was proposed; but he would direct attention to the matter when any Bill of the kind mentioned came on for second reading.

SATURDAY, AUG. 2.

Water Supply (Metropolis).—A petition for inquiring into the water supply of the Metropolis was presented from the Vestry of St. George-the-Martyr.

SOCIETY OF ENGINEERS.—On Wednesday last a party of gentlemen comprising the President (Mr. R. P. Spice), Secretary (Mr. Perry F. Nursey) and a number of the Members and Associates of this Society, were, by the kind permission of Messrs. Siemens Brothers, afforded an opportunity of visiting their telegraphic cable works at Charlton, near Woolwich. The party assembled at the works about twelve o'clock, and, under the guidance of Messrs. Siemens representatives, inspected the various processes connected with the preparation of the materials used in the manufacture of telegraph cables, the manufacture of the cables themselves, and of the various kinds of electric telegraph apparatus and instruments. In each department the amplest information was most readily and courteously afforded to the visitors, who manifested considerable interest in the various operations carried on in Messrs. Siemens extensive works, the inspection of which occupied about two hours. On leaving the works the party paid a visit to the *Faraday* telegraph cable ship, which was receiving on board the French Atlantic cable, and was expected to be ready in a few days to proceed on her voyage. Here luncheon was served, and the cordiality with which the visitors drank, among other toasts, success to the *Faraday's* enterprise, testified their appreciation of the hospitality they had received at the hands of the eminent firm who have been entrusted with the carrying out of this important work.

ASSOCIATION OF MUNICIPAL AND SANITARY ENGINEERS AND SURVEYORS.—The annual meeting of the members of this Association was held last Thursday, in the Hall of the Institution of Civil Engineers, Great George Street, Westminster—Mr. James Lemon, C.E., of Southampton, in the chair. The Honorary Secretary read the report of the Council, which stated that the meetings held during the year at Liverpool, Derby, and Wrexham had been a complete success. The result of the voting for the election of President for the ensuing year was a tie, each of the candidates—Mr. E. Pritchard, of Warwick, and Mr. G. F. Deacon, of Liverpool—having received 31 votes, and it was ultimately resolved that new voting papers should be sent out to the members, and that Mr. Deacon, who was President last year, should be invited to retain the office until the result of the voting was known. Mr. Deacon then took the chair, and on doing so said, as he had not anticipated that he should be asked to preside, he was not prepared with an address. Mr. James Schoolbred, B.A. read a paper on "Electric Lighting and its Application to Public Illumination by Municipal and other Bodies." Dealing first with the question of expense, he gave estimates showing that under three electric light systems—the Gramme "A" machine, the Siemens medium machine with the small-sized Siemens lamp, and the Jablochkoff system—besides the first outlay, the working expenses per hour of the system first named were for one light 1s. 6d., for two lights 2s. 1d., for three lights 2s. 7d., and for five lights 3s. per hour; for the second, 1s. 7½d., 2s. 4d., 2s. 10d., and 3s. 9d.; and for the third, for six lights 2s. 5d., and for 20 lights 6s. 5d. per hour. Another point discussed in the paper was as to the wholesomeness and pleasantness of the electric light as compared with gaslight.

Legal Intelligence.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

TUESDAY, JULY 29, 1879.

(*Before Justice* FRY.)

In re THE CADIZ WATER-WORKS COMPANY, LIMITED.

This was a summons adjourned from Chambers for the purpose of obtaining permission of the Court to call a meeting of the various classes of persons interested in the Company, with the object of sanctioning a scheme of reconstruction and discharge of the liabilities of the Company. The main features of the scheme were the payment by the first debenture-holders of £4672 13s. 4d. for the benefit of subsequent encumbrancers, and upon this they would obtain possession of the entire assets of the Company, which they proposed then to reconstruct, and to allow the subsequent encumbrancers to obtain preference shares in the new Company on the payment of a certain percentage of their nominal amount. As the scheme was worded, it appeared that without this further payment, or, as his lordship remarked, throwing good money after bad, the subsequent encumbrancers would be deprived of any share in the benefits.

Mr. GROSVENOR WOODS, who supported the scheme, said this was not intended, and he should be willing to introduce in the terms any modification which would make this clear.

Mr. COTTRELL, who appeared for the trustees of all the different mortgage bondholders, supported the scheme.

Justice FRY, in giving judgment, said this was an application under the Joint-Stock Company's (Arrangement) Act, 1870, which gave the Court the power to call meetings of creditors, with the view to their sanctioning arrangements between them and the Company, and which made such arrangement, if sanctioned by the order of the Court, binding on dissentients. Inasmuch as he was not now asked to sanction the scheme, the question he had to consider was whether, assuming the scheme now propounded were confirmed by a vote of the various classes of creditors, he should think it right to sanction it, and, in considering the question, he must bear in mind the very wide discretion given to the Court, remember that if he were to sanction it he should be binding those persons who did not assent to it, and, therefore, must have the most anxious regard to their interests. Now, he did not think he should sanction this scheme if it came before him with a single dissentient or non-assenting party, for this reason. The position of things was shortly this: There were trustees who had a first charge upon the assets of the Company by reason of their having advanced money for salvage purposes. Then there came, in order of priority, first, second, and third debenture-holders, and then the holders of debenture stock. It was proposed that there should be given to the second and third debenture-holders the following benefits under the scheme. First, a certain proportion of what might be called the free assets of the Company, which amounted to about £5000, and in respect of which the first debenture-holders were willing to withdraw from competition with the second debenture-holders and other creditors of the Company; and, secondly, preference stock in a new Company to be constituted for the purpose of working the property of the old Company. But it was proposed that before the second or third debenture-holders, or the consolidated stockholders of the Company should be entitled to any benefit in the new Company, they should respectively make payments of 10, 8, and 6 per cent. on the nominal amount of the bonds or stock. In other words, therefore, if they declined to make a further cash payment, the interest which it was proposed to provide for them in the new Company should be forfeited. Now, in his opinion, that was not a condition which ought to be imposed on dissentient bondholders. He did not think it would be wise or right to extend the Joint-Stock Company's Act, 1870, so as to enable companies to require from their creditors a further payment in cash as a consideration for giving them any benefit under the scheme. In this case it was now proposed to modify the scheme by confining the forfeiture to the interest in the new Company, not to the interest in the free assets; but the two seemed in principle equally objectionable, and on that ground he should decline to send this scheme for the sanction of the meeting. He would add that in his judgment it was quite possible to frame a scheme which would be free from these objections, and yet, to a large extent, carry into effect the objects of the scheme, and if such a scheme were brought before him he should be disposed to send it to a meeting for approval.

STAFFORDSHIRE SUMMER ASSIZES.

NISI PRIUS COURT.—SATURDAY, JULY 19.

(*Before Lord Chief Baron* KELLY *and a Special Jury.*)

TATTON *v.* THE STAFFORDSHIRE POTTERIES WATER-WORKS COMPANY.

The plaintiff in this action (Mr. Samuel Tatton), a dyer of silks, living at the Britannia Street Works, Leek, sought to recover damages from the defendants in consequence of losses alleged to have been sustained by him owing to their constructing a reservoir, and which subsequently led to his being compelled to dispose of his business at a sacrifice.

Mr. STAVELEY HILL, Q.C., M.P., and Mr. ALFRED YOUNG appeared for the plaintiff; Mr. MATTHEWS, Q.C., and Mr. JELF for the defendants.

Mr. HILL, in opening the case, said that the question which the jury would have to try was whether any, and, if so, what damage had been caused to the plaintiff by interference with the water of the River Churnet, running near Leek. This river was a wonderfully pure and bright stream, which had been found especially favourable for the purpose of obtaining and retaining the dye applied to the silk. After the silk had been steeped in the dye, it was immersed in a bright running stream uncontaminated by mud. The River Churnet, if it ever received any accession of mud from a fall of rain, would rapidly clear itself and admit of silk again being dipped in its pure water. From something like a century ago Leek had become the home of the trade of dyeing in this particular branch, and there had been on the banks of the river several works which had been carried on with very great profit to the dyers. About the year 1849 or 1850 the present plaintiff built upon land near the embankment two dye works. The works higher up the stream were called the Hencroft works, and those lower down the stream, which were of greater capabilities, were named the Mill Street works. Both wokrs were erected upon land bought especially for the purpose by Mr. Tatton, and after the buildings were erected the trade was carried on by him for many years with considerable success. At the Mill Street works there were employed in the process of dyeing about 25 men, and at the other works a much smaller number. The plaintiff carried on the trade of dyeing silk up to the year 1865. From 1858 to 1860, the Company against whom this action was brought, having obtained in 1853 an Act of Parliament for the purpose of forming water-works and supplying the Potteries towns about ten miles from Leek, proposed to build a reservoir. The water was taken away from the millowners down the stream, in order to supply the Potteries towns with water, and it became necessary to give the millowners compensation water. For this purpose a clause was inserted in the Act, by which the defendants were compelled to send water to the Churnet millowners as required. But there was also a clause in the Act which entitled any persons who suffered damage or injuries from the waters being made muddy by the interference of the Company to apply for compensation under the Act. For some time the reservoir did not do any very great damage to the water which the plaintiff received. The water, however, became contaminated, and got worse and worse, and in the year 1872 it was in a very bad condition, and almost worthless for the purpose of dyeing such a high-class material as silk. This, of course, seriously affected Mr. Tatton's as well as other works, and during the years 1871-72 the state of things was very serious, and Mr. Tatton found that his customers were falling off. To show that there was no need to call scientific evidence, Mr. Hill read the following admissions from the Solicitor of the defendant Company:—"I admit that the construction of the reservoir by the defendants has injuriously affected the water of the River Churnet for the purpose of dyeing and washing of silk, by rendering the state of the water more muddy and impure than was the case prior to the construction of the reservoir. . . . I admit that the case of *Clowes v. The Staffordshire Potteries Water-Works Company* was rightly decided by the Court of Appeal." The plaintiff was justified, on the strength of these admissions, in not calling scientific evidence. In the years 1870-71 things were very bad indeed, and the business of Mr. Tatton was falling off. He received numerous complaints from customers, and ultimately looked out for a purchaser of both works, and Mr. Wardle bought them; but they were sold at a very great loss. The action was brought about the 8th of January, 1878, the reason it was not brought earlier being that the plaintiff was short of money. The jury would no doubt hear from the defendants counsel something in reference to the Statute of Limitations. The writ in the present action was dated Jan. 8, 1878, and plaintiff could not, therefore, recover for anything in respect of the full and complete cause of action, which arose before January, 1872. But in respect of other injuries, as to which full and complete cause of action arose after January the 8th, 1872, the plaintiff was entitled to recover. The jury would have to decide what damage had been sustained by the plaintiff since the 8th of January, 1872, and the 27th of April of the same year, on which day Mr. Tatton sold his business. He (Mr. Hill) might point out that the injuries commenced, continued, and increased, and resulted in absolute necessity, culminating in the disposal of the business. The first head of the damage to which he should direct the attention of the jury was in reference to the depreciation in the price of the property as paid by Mr. Wardle compared with what it had cost the plaintiff. The plaintiff had given for land, property, and plant connected with the works something between £5000 and £6000, and he sold them for £3500, which was a clear loss of £1500. If counsel on the defendants side contended that the plaintiff was wrong in bringing this action in respect of that sum, then the plaintiff was thrown back on two other claims. After Mr. Wardle became the owner of the works the plaintiff rented the Hencroft works for three years, and during that time he sustained a loss of £2 per week, which amounted in all to £300, and in respect to Mill Street works his loss was £10 per week for fifteen weeks, amounting to £150, and making a total of £450. In conclusion, he cited several similar cases which had been successful and which had been brought against the defendants for contaminating the River Churnet.

Evidence was then given by the plaintiff and several witnesses as to the injury he had suffered, not only from the depreciated value of the works when he sold them, but also from goods which were returned to him through being improperly dyed. The case lasted all day, and was adjourned at the rising of the Court.

MONDAY, JULY 21.

Two other witnesses for the plaintiff having been examined this morning,

Mr. MATTHEWS proceeded to address the jury for the defendants. He said that when Parliament gave the Company power to take water from the Churnet, for the purpose of supplying the Potteries towns with water, it was made a condition that they should erect a reservoir, so that in time of drought the dyers and others using the water should not run short. That was the scheme of Parliament, and he thought it was a very equitable one. The River Churnet was one that was often much swollen, and at times was flooded. On these occasions a good deal of mud was brought down into the reservoir, it accumulated at the bottom, and, of course, when the water came down again it was stirred up, and the river made muddy longer than it would otherwise have been, and every time there was a flood there was a recurrence of this. While water was muddy it was unfit for dyeing purposes. In the old days they were told that the mud would wash away in 24 hours or less, but now it was often two or three days. Then there was no doubt that as the accumulation of mud increased, so did the muddy nature of the water. These facts were quite obvious, and he had admitted them to save expense and trouble. It followed that the Company would be bound to make compensation to those who had acquired a right to use the water, as it remained muddy longer than it did before the construction of the reservoir. The question the jury had to decide was whether or not plaintiff had any such rights. On this broad issue he asked for their verdict. He submitted that the plaintiff had no right in respect of the works at the time he sold them to Mr. Wardle. He purchased the works in 1847. His property did not touch the Churnet, the public highway coming between. The utmost he would have would be one-half of the road, and this would not bring him to the river at all. In addition to the road, there was a piece of waste land which no one seemed to think it worth while to claim. The plaintiff himself was once asked to repair the fence because some children had strayed on it and fallen into the river; but he had repudiated the ownership, and declined the work. He (Mr. Matthews) should contend that plaintiff had no more right to that strip of land than had one of the jury. The plaintiff thus had no right of proprietorship over the water. The only other right he could possibly have would be by prescription—*i. e.*, by long uncontested usage, over a period of at least 20 years. What were the facts? The plaintiff had told them that he bought the works in 1847, and that he then put down a pipe across this piece of land, which had been called a mud-bank, to the River Churnet, and had thus used the water. He had been compelled to admit that he had paid an acknowledgment for this pipe. Lord Macclesfield had a mill a little lower down the Churnet. His agent, seeing that the plaintiff, by drawing the water out of the Churnet, was infringing the rights of the Earl, thereupon insisted upon the payment of an acknowledgment of 6d. per annum. In the witness-box, plaintiff, who was not wanting in shrewdness, endeavoured to establish that he paid that acknowledgment for permission to put a plank out into the stream for the purpose of washing his silk. But that was below the mill, and clearly could not injure the water, for the millowner, Mr. Tatton, was a little surprised when the written agreement was put in with reference to this. Two witnesses would be called to prove that the plaintiff had stated that he had acknowledgment of taking the water. In 1847 he put in the pipes and went on for eleven years, till 1858, when the reservoir was completed. Hence he (Mr. Matthews) should submit that no right had been acquired to use the water in the Churnet. They had it in evidence in 1859 that the water had become muddy, and that it was unfit for dyeing. Could, then, the plaintiff possibly claim that he had acquired a prescriptive right to clean water by using what was admitted muddy?

Certainly not. Had clean water been used for 20 years, it would have been a totally different thing. He therefore submitted that, upon the admitted facts, the plaintiff had never acquired the right to draw pure water from the Churnet. The plaintiff told them that in 1867 the water was so bad that his trade had all left him. What if it had? He had never acquired a prescriptive right by 20 years user, and he sold the works to Mr. Wardle in 1872. Then with regard to the Mill Street works. Plaintiff bought the land for them, and erected the dye-works. Here, he would admit, that the question was somewhat different, for here the plaintiff had a proprietary right. The law of this country was to the effect that a man holding property on the banks of the river had a right to use any of the water in what were called the ordinary uses of water. For instance, he could use it for domestic purposes, or for cattle to drink, and he had a right to complain if anybody should diminish the quantity of the water or lower its quality. That was a very simple question, and he would not dispute it, but when they came to use the water for washing silk, he should hold that no right was acquired as proprietor. A right could be gained by 20 years user, but by no other. He took it that by law no man could draw out of a river any such quantity as 20,000 gallons a week, or 1½ millions a year. Thus it had been held that a man had no right to turn the water from a stream on to his land for the purpose of irrigation. If he set up such a right he could only support it by saying that he had exercised it without challenge for 20 years. In this case the water was used for five years, or suppose they said six or seven. His learned friend had introduced into the case, with the evident view of creating a prejudice in favour of the plaintiff, the fact that a Miss Clowes and Mr. Wardle had received compensation from the defendants. These cases were decidedly different. In the case of Miss Clowes, an application was made to the Court of Chancery, and after a lengthy litigation an interim injunction was obtained restraining the defendants from using the reservoir. This was a most serious matter, involving several thousands of pounds, and it was thought advisable to come to terms, which was accordingly done. Mr. Wardle waited till 1873, when he made a claim. This was not admitted, but it was thought advisable to purchase from him a release of the whole of his rights. Accordingly, for £1750 he released everything for himself, his executors, his heirs, his assigns, and his tenants. The plaintiff claimed from the defendants in 1872, in the county court, £2 14s. 2d., being the amount he had paid for one year to the Leek Improvement Commissioners for the use of the town water, which one of the witnesses had said was quite fit for any dyeing purposes. At this time he said nothing of the very large claim for damages which he had since brought, and which was as much due then as now. The county court action was adjourned over periods of five years by the judge, in order to see what would be the decision in Miss Clowes's case. Why could not the plaintiff have written to the defendants that although he was only suing them for two pounds odd, he had a heavy claim besides? But he did nothing of the kind. As to the claim for damage to the freehold value of the works on their sale, the plaintiff could not demand it, because he had not exercised the right of using the Churnet long enough. Besides, a large portion of the claim was barred by the Statute of Limitations, and the claim for damage while tenant was barred by Mr. Wardle's agreement. It was true that the plaintiff was tenant of the Hencroft works for three years under Mr. Wardle, and it might be that he had to give up his tenancy in consequence of the muddy nature of the water; but the agreement with Mr. Wardle expressly stipulated that that gentleman sold all his tenants rights to the water.

Witnesses in support of the Company's contention were then called.

Mr. JELF having replied on behalf of the defendants, and Mr. HILL for the plaintiff, his LORDSHIP summed up the case, and the jury, after considering for half an hour, returned a verdict for plaintiff—damages £1400.

Miscellaneous News.

METROPOLIS WATER SUPPLY.

The following are the returns of the Society of Medical Officers of Health on the Composition and Quality of the Metropolitan Waters in July, 1879:—

Names of Water Companies.	Total Solid Matter per Gallon.	Oxygen required by Organic Matter, &c.	Nitrogen — As Nitrates, &c.	Ammonia. Saline.	Ammonia. Organic.	Hardness (Clark's Scale). Before Boiling.	Hardness (Clark's Scale). After Boiling.
Thames Water Companies.	Grs.	Grs.	Grs.	Grs.	Grs.	Degs.	Degs.
Grand Junction	21·74	0·139	0·105	0·000	0·011	14·2	3·0
West Middlesex	21·00	0·135	0·095	0·000	0·011	13·3	3·0
Southwark and Vauxhall	19·80	0·133	0·120	0·000	0·008	14·2	3·8
Chelsea	19·00	0·105	0·120	0·000	0·010	14·0	3·0
Lambeth	20·80	0·105	0·094	0·000	0·006	13·2	4·8
Other Companies.							
Kent	27·90	0·001	0·300	0·000	0·001	18·2	5·1
New River	19·80	0·056	0·135	0·000	0·003	14·0	4·0
East London	21·80	0·066	0·105	0·000	0·007	14·0	3·6

Note.—The amount of oxygen required to oxidize the organic matter, nitrites, &c., is determined by a standard solution of permanganate of potash acting for three hours.

The water was found to be clear and nearly colourless in all cases.

C. MEYMOTT TIDY, M.B.

THE METROPOLITAN BOARD'S WATER BILLS.—At the meeting of the Metropolitan Board of Works last Friday, a report was brought up from the Works and General Purposes Committee, in regard to a letter recently received from the Vestry of Paddington, inquiring whether the charges incurred by the Board in the promotion of the twe Metropolitan Water Bills were included in the precept issued to the Vestry; and recommending that a reply be sent to the Vestry in accordance with the report by the Accountant upon the subject. The Committee said:—"Your Committee have received from the Accountant a report, stating that the expenses incurred by the Board in promoting the Water Bills of 1878 have been advanced out of the £60,000, standing balance of the General Working Account, and no portion of the money received from the Vestry of Paddington during 1879, in satisfaction of the Board's annual precept, will be applied to meet such expenses, unless proper authority be obtained to neutralize the Auditor's disallowance." The motion was put and carried without discussion.

REDUCTION IN THE PRICE OF GAS AT WHITEHAVEN.—Both the Gas Companies supplying Whitehaven—the Whitehaven Gaslight Company, Limited, and the Whitehaven Consumers Gas Company—have given notice that from and after the 1st day of July, until further notice, the price of gas to private consumers will be reduced from 3s. 7d. to 3s. 4d. per 1000 cubic feet, and that a discount of 2d. per 1000 cubic feet will be allowed to consumers of 75,000 feet and upwards annually.

CAMBRIDGE UNIVERSITY AND TOWN GASLIGHT COMPANY.

The Half-Yearly Meeting of this Company was held last Thursday—the Rev. Dr. PHELPS in the chair.

The SECRETARY read the minutes of the last half-yearly meeting, which were confirmed. The following is the Directors report:—

The Directors recommend that a dividend for the half year, after the rate of 10 per cent. per annum on the consolidated stock, and after the rate of 7 per cent. per annum on the amount paid up on the new shares, be paid on the 1st of August next, free of income-tax.

The profit and loss account shows a considerable increase of receipts over expenditure, which is accounted for by the result of the general working of the last half year as compared with that of the corresponding period of the previous year, and the low price at which the Directors have been able to purchase coals. And although it is not to be expected that such an increase can be permanently maintained, seeing that revenue must shortly be charged with a considerable outlay in remodelling the old retort-house and other works, and that the present low price of coals may not continue for any great length of time, the Board is nevertheless desirous that the public may participate in the present prosperity of the Company, and they have therefore further reduced the price of gas 3d. per 1000 feet from Midsummer last.

Also, considering the present condition of the Company's affairs, the Directors feel it to be their duty, in the interest of the Shareholders, to recommend a further payment of 10 per cent. on the consolidated stock, on account of the deficiency in dividends in previous years.

A resolution will be proposed to the Shareholders for the creation of additional capital to the extent of £25,000, to defray the cost of the new works now in course of construction, and which the Directors confidently hope will be in operation next winter.

The retiring Directors are the Rev. Dr. Phelps and Mr. Charles Balls, who are eligible for re-election.

The retiring Auditor is Mr. George William Fitch.

The Manager (Mr. J. Weeks) in his report to the Directors states that the increase in the sale of gas has been quite equal to former periods. The new works are being completed as speedily as possible. The illuminating power, pressure, and purity of the gas has been kept to the required standard.

On the motion that the report of the Directors be received and entered on the minutes,

Mr. WELSFORD, in moving as an amendment that the adoption of the report be deferred, said he should like to make a remark or two with regard to the further payment of 10 per cent. on the consolidated stock, recommended by the Directors in their report. He would urge that the surplus dividend should be applied to further reduce the price of gas.

Mr. BOND seconded the amendment, and said that a resolution had been passed at a committee meeting of the Improvement Commissioners, recommending the Commissioners to take counsel's opinion as to the right of the Company to do this, and that they be requested to defer the adoption of their half-yearly report until an opinion on the question had been given.

The CHAIRMAN said they had not received any such request, but a copy of the resolution had been sent to them.

Mr. BOND said they were very much indebted to the Directors for the way in which, during a course of years, they had managed the affairs of the Company, but he thought they would show a proper feeling and spirit in suspending the adoption of the report until the Commissioners had had an opinion as to the legality of the course proposed. By section 33 of the Company's Act, when the shares were paying more than 10 per cent., they were to invest the surplus until it reached the sum of £3000, to meet any deficiencies that might arise in the next or succeeding years.

The SECRETARY said he might save Mr. Bond some trouble by stating that the Act to which he was referring had been repealed.

The CHAIRMAN said the Directors had done nothing illegal. Mr. Bond might rest assured that he (the Chairman) would not have given his name to any illegal steps on their part.

Mr. BOND said he could scarcely conceive that a number of gentlemen on the Improvement Board would have sent a resolution to the Directors unless it was in accordance with legality.

The CHAIRMAN said Mr. Bond was referring to the Act of 1867.

Mr. BOND thought that the action he recommended would be graceful and consistent, and would accord with the feeling of the town. He felt sure the Directors would not go contrary to the spirit of the Act for the sake of putting a few pounds into the pockets of the Shareholders. When the Company made more than 10 per cent., he did think that the surplus should go to the town. He did not think that the clause providing for that had been abolished.

The SECRETARY said Mr. Bond might not be aware that the Improvement Commissioners had opposed the Company very strongly when their Bill was before Parliament, and petitioned to have the very section to which Mr. Bond was referring re-incorporated in the Act; but the Parliamentary Committee rejected the petition, the Chairman stating that the Committee considered the Commissioners should have nothing to do with the accounts of the Company.

The CHAIRMAN said they had been advised by counsel as to the legality of the transaction. He had been very much influenced by one circumstance in the matter, that no reserve-fund, in the sense of a reserve-fund spoken of and authorized by the Act, could, according to the Act, be commenced until every holder of consolidated stock had received the full 10 per cent. per annum, with arrears, if any, of the dividend of former years. And thus it was that their undivided profits had gone on accumulating until the Directors thought that, in justice to the Shareholders, something should be done with the surplus. They had expended the surplus on their present works as long as they could. They had not the power to apply the surplus to the erection of new works. They had, under the advice of their very able Engineer, begun to erect new works. Whether those works were retained by the Company, or transferred to the town, he would be proud to think that they would be found worthy of the town. He ventured to believe that when they had these new works in operation, and when they had applied some of their surplus profits to remodel the old works—which could not be done before the new works were ready—then, in his opinion, they would be in a position to further reduce the price of gas. It was now at 3s. 6d. per 1000 feet. The light was such as no light could compete with under the same conditions and terms. They had an excellent and well-chosen Manager, while with the advantage of such works as those they placed at his disposal, and supposing the price of coal was not enormously increased, the price of gas would be reduced again. The present profits enabled them to pay some of the former dividends.

Mr. BOND said if the works were in full working order there must be some show of reason in their proposing to pay the Shareholders this extra 10 per cent. He thought they should utilize surplus profits to raise the £25,000. They knew very well that they were buying coals at one-third of what they were, and yet they were only reducing the price of the gas 1-20th. What he objected to was that they were going back so many years. He thought they should give the Commissioners an opportunity of passing their proposed resolution.

Mr. LILLEY said they had been told that the clause referred to by Mr. Bond existed unrepealed. Four lawyers were present at the committee meeting of the Commissioners, and they all appeared to concur in that view.

Mr. WELSFORD complained that the distribution of the surplus profits was not extended to the holders of £10 shares, who were thoroughly ignored, though he was satisfied with his own proportion of the profit.

The SECRETARY said they had no legal powers to distribute the surplus to those Shareholders who had had 7 per cent. all along. But the holders of consolidated stock had not received their full dividends in former years, and the Act of Parliament said that they should receive them before certain things were done.

The amendment—"That this meeting does not approve of that part of the report recommending the payment of an additional 10 per cent. on the consolidated stock"—was then put and lost, and the report was adopted.

On the motion of the CHAIRMAN, seconded by Mr. G. W. FITCH, it was resolved that a dividend be paid in accordance with the recommendation of the Directors.

The CHAIRMAN then moved that additional capital to the extent of £25,000 be created. He said that it became an absolute necessity to do this. As they all knew, the consumption of gas had been daily increasing. They had gone on with the old works till they could not go on any longer. They had taken the opinion of perhaps the best authority in the country—Mr. T. Hawksley—who advised them to have such works as they were now erecting. When the new works were ready they would be able to improve the old ones. Therefore they were asked to create this new capital in order that the town might in future have works adequate to all probable demands for years to come.

Mr. S. PEED seconded the motion, which was agreed to.

Mr. S. PEED proposed the re-election of Dr. Phelps as a Director, and thanked the Directors for their services. He referred in complimentary terms to the zeal with which they attended to the interests of the Company. Dr. Phelps was well known among the Shareholders as an able Chairman, who energetically devoted his talents, ability, and time not only to the Company and to the town of Cambridge, but from the eloquent addresses with which he favoured them in the interests of the Company, he had made himself known in the gas world. As an accomplished chemist, Dr. Phelps took an especial interest in all that related to the processes connected with the manufacture of gas carried on at their works. There would be no difficulty about this vote. There had been a fair and impartial discussion. Some gentlemen had come in who were not very well acquainted with the working of the Company. They must excuse those gentlemen who had not had the matter brought under their notice, and who had been arguing upon an Act of Parliament that had been repealed. He hoped that they would all leave the room feeling satisfied that the Directors had done justice towards the Shareholders.

Mr. C. BALLS seconded the motion, which was carried.

Mr. NUTTER proposed, and Mr. FITCH seconded, the re-election of Mr. Charles Balls as Director, which was agreed to.

The CHAIRMAN said that if there was anything that encouraged a man to go on with his work, it was the approbation of the public. He could not help thinking that among the community satisfaction would be expressed at what had been done. He would take the opportunity of expressing his gratitude to his colleagues at the hearty way in which they went into the financial business of the Company. He could assure the meeting that the Directors and Officers were most assiduous.

Mr. BALLS also returned thanks for his re-election, and said he was first elected in 1848, when it was no sinecure to sit there and be badgered by a few Shareholders who had joined the Company with the sole object of annoying the Directors.

The retiring Auditor (Mr. G. W. Fitch) having also been re-elected, a vote of thanks to the Chairman for taking the chair, and to the Directors for their able and successful management of the affairs of the Company, was passed.

The CHAIRMAN briefly responded, and the proceedings ended.

WALTON-ON-THAMES GAS COMPANY.

The Half-Yearly Meeting of this Company was held last Saturday—E. H. J. CRAUFURD, Esq., in the chair.

The report showed an increase of 20 per cent. in the consumption of gas during the past half year, with a net profit of £1375 13s. 8d., out of which the Directors proposed the payment of a dividend of 8 per cent.

The CHAIRMAN, in moving the adoption of the report, stated that £174 8s. 2d. had been written off the value of the railway coal waggons belonging to the Company, and alluded to the sum of £300 which had been carried to the depreciation-fund. He informed the Shareholders that a contract for the supply of coals had been entered into for the next two years, at a reduction of 1s. 3d. per ton. Another pleasing feature was, he said, the low leakage, which worked out to 5¾ per cent. for the past half year. Under these favourable circumstances, the Board had given notice to reduce the price of gas by allowing a discount of 6d. per 1000 feet for prompt payment. He also called attention to the resolution which was agreed to at the half-yearly meeting of Shareholders in February, for the expenditure of a sum of £75 in the purchase of a suitable testimonial to be presented to Mr. George Anderson, on behalf of the Shareholders, for the services rendered by that gentleman in the reconstruction and reorganization of the works and business.

The motion for the adoption of the report was seconded by Mr. T. A. HICKLEY.

Mr. R. H. JONES then severely criticized the accounts and balance-sheet, contending that the prosperity of the Company was more apparent than real. All the capital of the Company had been raised, and no more money could be borrowed, while the net earnings of the Company during the past twelve months had been only sufficient to meet the necessary outlay for extensions (which should have been carried to revenue account), to pay a dividend of 7½ per cent. for the year, and the £75 to Mr. Anderson. In the general balance-sheet two items, amounting to £237 17s. 5d. had been transferred from capital account to stocks on hand, so that the real balance of floating assets in July, 1879, exceeded that of 1878 by 11s. 6d. only. He (Mr. Jones) did not, therefore, see how the proposed reduction of 6d. per 1000 feet to consumers could be met, as the only favourable feature for the future was the reduced cost of coal, which scarcely amounted to 1¼d. per 1000 feet, and the prospects of better profits from the manufacture of sulphate of ammonia.

After a discussion of upwards of an hour, in which all the Shareholders coincided that the reduction in the price of gas was premature, and should have been submitted to them before notice was given to the consumers, the report and accounts were adopted, and the dividend of 8 per cent. declared.

On the motion of Mr. R. H. JONES, the resolution to allot the sum of £75 to Mr. George Anderson was unanimously agreed to, as also a vote of thanks to the Chairman.

REDUCTION IN THE PRICE OF GAS AT UTTOXETER.—As from Lady-day last, the price of gas at Uttoxeter has been reduced from 5s. to 4s. 2d. per 1000 feet, and there has also been an alteration in the discounts allowed. Formerly they were, for all gas burnt in any one year ending at Lady-day, above 25,000 and under 50,000 feet, 5 per cent.; above 50,000 and under 100,000, 10 per cent.; above 100,000, 15 per cent. In future they will be, for all gas burnt in any one year ending at Lady-day, of 30,000 feet and upwards, 10 per cent., to commence from Lady-day, 1879.

REIGATE GAS COMPANY, LIMITED.

The Annual General Meeting of this Company was held last Thursday—Mr. JOHN PAYNE in the chair.

The following report and statement of accounts were presented to the Shareholders:—

Your Directors, in submitting the accompanying statement of accounts to the Shareholders, have much pleasure in being able to report that the working of the Company for the past year has been very satisfactory.

A favourable contract for a supply of coal having been made, it was determined that the price of gas to private consumers should be reduced to 4s. 6d. per 1000 cubic feet, the reduction to take effect from the March quarter, and your Directors trust that a large increase in the consumption of gas will follow the reduction in price.

The works and plant of the Company have been maintained in an efficient state, and several important renewals have been made and paid for out of revenue.

In order to simplify the accounts, your Directors recommend that the remainder of the fully paid-up shares shall be converted into stock, and a resolution to that effect will be submitted to you.

The balance-sheet shows a profit of £2006 19s. 4d., out of which your Directors recommend that a dividend be declared on the paid-up capital of the Company, at the rate of 10 per cent. per annum, free of income-tax, an interim dividend of 5 per cent. having been paid in January last, leaving the moiety dividend of 5 per cent. to be paid on the 31st of July; that a further sum of £300 be added to the insurance and contingency fund; and that the balance, £201 1s. 4d., be carried forward to the next account.

The retiring Director is Mr. C. J. Smith, who, being eligible, offers himself for re-election.

Profit and Loss Account, June 24, 1879.

Stock of coals on hand, June 24, 1878	£100	16	0	Balance brought forward from 1878	£99	14	0
Cash paid for coals since	2104	4	11	Gas and meter rentals	4546	18	6
	£2205	0	11	Product and sundries	1102	13	11
Less stock now on hand	447	0	0	Services	94	15	10
	£1758	0	11				
Purifying materials	61	10	6				
Trade charges	507	0	0				
Rent, rates, and taxes	124	1	9				
Direction	105	0	0				
Wages for manufacture	476	18	0				
Do., distribution	81	0	0				
Renewals	299	8	0				
Salaries and commission	424	3	9				
Balance carried down	2006	19	4				
	£5844	2	3		£5844	2	3
Cash paid interim dividend at 5 per cent., to Christmas, 1878	£725	19	0	Balance brought down	£2006	19	4
Balance	1254	0	4				
	£2006	19	4		£2006	19	4

The CHAIRMAN, in moving the adoption of the report, congratulated the Shareholders on the prosperous condition of the Company, expressing his belief that few small companies were in so good a position.

The motion having been seconded,

The CHAIRMAN said he should be pleased to hear any remarks the Shareholders might wish to make.

Mr. STEELE complained that no notice had been taken of his objection to the Company having a Managing Director, and he now warned the Directors that the appointment was illegal, and unless his wishes in the matter were carried out he could take proceedings in Chancery to compel them to alter the present arrangement. He therefore wished to know distinctly if the Chairman would undertake that the illegal office of Managing Director should be abolished.

The CHAIRMAN pointed out the great benefit the Company had derived from the good management of that gentleman, and could not promise that any alteration would be made.

The MANAGING DIRECTOR (Mr. C. R. Mead) explained to Mr. Steele that there was nothing uncommon or illegal in the appointment of a managing director, the appointment being perfectly legal when made, as his was, by the Shareholders at a general meeting summoned for the purpose. Mr. Steele had made a great many remarks, and professed to be acquainted with the doings of a number of gas companies, and it would, therefore, be quite fair to ask him if he could name another small company who had during the last year realized from the sale of products two-thirds the cost of the coal carbonized, and made enough profit to pay 15 per cent. if considered desirable to do so. The Shareholders were, however, satisfied with 10 per cent., and every year some £500 was added to the value of the Company's property.

The resolution was then put and carried.

Some other business having been disposed of,

Mr. F. MEAD proposed, and Mr. STEELE seconded, a resolution to the effect that £30 per annum be added to the present remuneration of the Directors, which was carried unanimously.

The retiring Director was re-elected, and a cordial vote of thanks to the Directors for their able management of the Company's affairs terminated the business of the meeting.

THE WEARDALE AND SHILDON WATER COMPANY AND THE WATER SUPPLY OF DURHAM.—A circular has been issued to the Shareholders of the Weardale and Shildon District Water-Works Company, in place of the half-yearly report, announcing that the Company's Act of this year provides for only a yearly meeting; that the Bill passed through Parliament without opposition or substantial alteration; that the works which are necessary for a supply of water to the city of Durham will be sufficiently completed to give a supply on the 1st of January next; and that an interim dividend at the rate of 3½ per cent. per annum, clear of income-tax, will be paid on the 8th inst.

PEEBLES'S PATENT METALLIC NEEDLE GOVERNOR.—In the early part of the present year, Mr. D. Bruce Peebles, of Edinburgh, read a paper before the Royal Scottish Society of Arts, on the subject of the Needle Governor in connection with gas illumination; and a Committee was afterwards appointed to investigate the merits of the invention described in the communication. This Committee—consisting of Dr. Stevenson Macadam, Mr. John Milne, and Mr. John Reid, late Engineer of the Edinburgh and Leith Gas Company—after an extended trial of the governor, under varying conditions, have presented the following report to the Society:—"Your Committee having met and considered this communication, are clearly of opinion that the Needle Gas-Governor, invented and described by Mr. D. Bruce Peebles, is a great improvement on all previous gas-governors, alike in simplicity of construction, durability of material, accuracy of adjustment, and general adaptability for the consumption of gas under all conditions and circumstances. Your Committee have had the advantage and privilege of experimenting with the Needle Gas-Governor, and are convinced that this governor is the most perfect instrument which has been invented up to the present time for controlling the flow of gas. They cordially recommend the communication to the very favourable consideration of the Publication and Prize Committees.—(Signed) Stevenson Macadam, Ph.D. (Convener), John Milne, John Reid."

BIRMINGHAM CORPORATION WATER SUPPLY.

The new pumping-station of the Birmingham Corporation Water-Works, at Selly Oak, was opened last Tuesday by the MAYOR (Mr. J. Collings), in the presence of a large party of gentlemen who had been invited by the Chairman of the Water-Works Committee (Alderman Avery).

The pumping machinery having been set in motion,

Alderman AVERY explained the use and capacity of the different apparatus. He said that the opening of this station might fairly be regarded as an event of considerable importance, as it formed an addition to and development of that vast system of deep wells, and of water diverted from streams and impounded in reservoirs, which collectively constituted the water supply for the city and surrounding district within the water area, representing a population of something over 500,000 persons. The difficulties arising from the geographical situation of Birmingham would at one time have been regarded as almost insuperable ones in the way of obtaining anything like an efficient supply of water. The town stood on the highest table-land in England. The streams were not numerous, and the red sandstone rock shelved off in all directions; so that the provision of a water supply so ample in quantity and pure in quality as that which they now possessed, could only be regarded as a triumph of engineering skill. There was an unlimited supply to all but the highest houses in the town, and these would now be reached by the erection of a new stand-pipe at Edgbaston. With regard to the ornamental character of the structure, they might perhaps have saved a few hundred pounds if they had erected a plainer one. The land, however, was given them by Lord Calthorpe, and it was hardly to be expected that his lordship would have given it if anything in the form of an ugly tube had been put up. The gift of the land was more than equivalent to any economy that could have been obtained by merely putting up an ordinary column, instead of the elegant structure which was now being erected. The same might be said with regard to the character of the arrangements of the pumping-station which they were now opening. They might have saved a small sum by having everything very plain and very ugly. The powers for pumping the well at that station were obtained by the Directors of the late Water-Works Company by the Act of 1870. The Directors commenced the works, and they were in an unfinished state at the time of their transfer to the Corporation in January, 1876. Up to that time the Directors had spent upon the works about £5000, and they remained in their unfinished condition until the last few months, when, by reason of the increase of the population, it was thought necessary to complete them. The well was 12½ feet in diameter; and, beginning at the surface, it struck down through the sandstone rock to a depth of 150 feet. Then below that there was a bore-hole which extended downwards 150 feet farther, giving a total depth of 300 feet. The Engineer, with a view to altogether excluding the surface water — that terrible bugbear of water supply — had surrounded the well with a solid casing of masonry 14 inches in thickness, and extending 80 feet from the surface. The situation of the works was admirable, and reflected great credit upon the Directors of the late Company and the Engineer. The works were situated immediately alongside the canal, and there was ample space for the storeage of mains and appurtenances necessary for the water supply of the neighbourhood. He believed there would be a saving in cartage of about 3½ miles, which represented annually a very considerable amount. The engine beam was 31 ft. 6 in. in length, and was 20 tons in weight. The cylinder was 60 inches in diameter, and had a stroke of 11 feet. The well pump had a stroke of 10 feet, and was 20 inches in diameter. Behind the well was a double-acting pump of 17 inches diameter and 7 feet stroke, which forced the water either to the Hagley Road or the Monument Lane reservoir through the 20-inch mains recently laid down, and also over the stand-pipe to supply the highest houses at Edgbaston. The total lift of water to the top of the stand-pipe at Edgbaston was 390 feet above the surface. They were thus able to give to the highest buildings an uninterrupted supply of water at a charge which the Water Committee considered merely nominal. The cost of the works, including land, buildings, well sinking, and engines, was £36,566. It was intended as part of the plan for which powers were obtained, that galleries should be struck out, which would enormously increase the extent of the gathering-ground. In making those galleries they were likely to come upon a fault in the sandstone, in which case they would vastly increase the volume of water. The Corporation had now five deep wells. The grand old well at Aston gave them steadily 3 million gallons of water a day, and the construction of other wells appeared to have no appreciable effect upon it, showing from what an immense area the water was obtained. It was a fixed rule amongst water engineers that for a supply of 1 million gallons of water a day it was a financial success if the cost was not more than £30,000. The Corporation would have 2 million gallons at a cost of a little over £40,000. Whether the new station was regarded as a triumph of engineering skill or as a contribution to the Water Department, it was eminently satisfactory.

The MAYOR, at the request of Alderman Avery, declared the pumping-station opened. He congratulated the Water Committee upon the successful completion of this part of the work. They could, he said, hardly over-estimate the advantages of a good supply of pure water, and he thought the Town Council were fortunate in having a gentleman who presided over the work of the Water Department with self-sacrificing zeal and ability as did Alderman Avery. It was only an evidence of the splendid manner in which Birmingham was served in its various departments by men who performed their duties not in any perfunctory manner, but as though every penny was going into their own pockets.

After having examined the engine and its operation in raising water, the company were entertained at luncheon by Alderman Avery.

PRESENTATION TO MR. W. DALEY, OF INVERCARGILL, NEW ZEALAND.—On the afternoon of Wednesday, June 4, a presentation of a handsome silver salver was made to Mr. W. Daley, who has for some years past successfully managed the Corporation Gas-Works at Invercargill. The presentation was made by the ex-Mayor (Mr. Cuthbertson), who expressed the very general regret that was felt at the approaching departure of Mr. Daley for England. He said that when he arrived he was comparatively unknown, and what reputation he had secured, and what respect he commanded, were due to his own actions. The health of Mr. Daley having been drunk, and three cheers given for him, his wife, and family, he thanked the subscribers for their gift, which he said he should look upon as a *souvenir* to be valued. During the time he had been gas manager, he had used every endeavour to bring the gas to perfection, and he prided himself that Invercargill had during that time occupied a foremost place in the colony as regarded the brilliancy and illuminating properties of its gas. He again thanked those who had given the necessary sum for such a handsome present. Especially would it in future years serve to remind his daughter of the appreciation in which her father was held in Invercargill, her birthplace. The following is the inscription upon the salver:—"Presented to Mr. William Daley, Gas Engineer, by the principal gas consumers of Invercargill, New Zealand, in appreciation of services rendered by him in erecting the local gas-works, and successfully managing them for four years, the quality of the gas supplied being unexceptionable. Invercargill, New Zealand, May, 1879."

MIDLAND ASSOCIATION OF GAS MANAGERS.

The Seventh Quarterly Meeting of this Association was held at the Midland Hotel, Birmingham, on Thursday, July 17—Mr. CHARLES HUNT, of Birmingham, presiding.

The HONORARY SECRETARY (Mr. J. Tindall, of Walsall) read the minutes of the previous meeting, which were adopted.

Mr. J. M. DARWIN, of Longton, then read a paper on

THE MANUFACTURE OF GAS FROM COAL SLACK.

Slack for the production of gas has been in general use at the Longton Gas-Works for upwards of twelve years, varied only by the use of burgy, a term used in North Staffordshire and elsewhere for a compound of coal and slack. This burgy, which I believe should be unscreened coal as drawn from the pit, varies in its quality when delivered for gas-making purposes. I have known it at its best to be about half coal and half slack, at other times nearly all slack; but it often consists of about one-third round coal, and the remainder of more or less of slack, with occasionally a sprinkling of small cobbles. With good clean slack I have found I could get quite as good results as from much of the so-called burgy, and, as burgy is quoted at least 2s. per ton dearer, I have found it cheaper to use slack instead of the mixture.

In treatises on the manufacture of coal gas I have not been able to find any reliable information as to the production per ton, and the illuminating power of the gas as derived from the gas coals of the North Staffordshire coal-field. Yet these coals are used in very considerable quantities for gas-making purposes. They are used in all the gas-works in the Potteries, and in several of those of the neighbourhood; also in many gas-works in the South, and some of the coal is a favourite in the London market, where it is sold for domestic uses.

Mr. Lewis Thompson, it appears, has made several analyses of the coal, which are quoted by Mr. Newbigging in his "Handbook," but they do not give the important information of the amount of gas derived per ton, nor the illuminating power. The results of a series of experimental tests of the different coals of this district for this purpose would be very useful; but I believe it may be taken that, in practical working, the best coal produces 9500 to 10,000 cubic feet of gas to the ton; burgy from 9000 to 9600 cubic feet, according to quality; and good clean slack from 8500 to 9300 cubic feet. Out of some of the slack I have produced 10,000 cubic feet of gas to the ton; but the seam from which this slack was taken is, I believe, worked out. I have, however, obtained nearly 9200 cubic feet to the ton from the slack used in the half year ending the 31st of December last. There are other qualities of coal sold called beans and nuts, and to get out of these 9500 cubic feet to the ton, on the average, may be reckoned good working.

I have often heard it said that if I used slack I must of necessity use cannel to get up the illuminating power, but I have not found it necessary to do so (the cannel used during the half year being some cheap shale found in the neighbourhood), and find no difficulty in maintaining a standard of 15 candles, as tested by Sugg's "London" burner, without using a particle of cannel.

The amounts of tar and ammoniacal liquor derived per ton of slack, &c., used during the half year are given in the working statement laid upon the table for your inspection, and, as you will see, are respectively 9·87 gallons of tar and 32½ gallons of ammoniacal liquor of 4° Twaddel.

As regards the sulphur compounds in the gas made from the North Staffordshire coal, I believe they are above the average, and I have found that, working with about an equal quantity of lime and oxide of iron in the purifiers, and using two small scrubbers with ammoniacal liquor, there was at times upwards of 50 grains of sulphur in 100 cubic feet. With this amount of sulphur there could not but be an outcry made against the sulphurous smell of the gas when burned in a room for two or three hours, and I believe that in the other towns in the Potteries there was the same, or even greater objection to the gas supplied. At any rate, gas analysts were appointed in Burslem, Stoke, and Hanley, but not in Longton, and probably this may be attributable to the use of slack, which, when clean, does not contain so much pyrites as coal does, or it may be that in the six-hour charges, as generally practised, the slack would not be so completely spent, and consequently less sulphur would be given off. Since, however, the erection of a Mann and Walker's scrubber—and they are universally used in the gas-works in the Potteries—the sulphur compounds can be reduced to a tolerably uniform rate of 20 grains in 100 cubic feet, and complaints on the score of sulphur are now rarely heard.

The coke made from the slack is large, and of a hard, grey appearance. It commands as good a price as any in the Birmingham market. The coke made from the coal is smaller, but whether made from slack or coal, it contains a large percentage of sulphur.

When the Longton Gas-Works were first built, some 21 years ago, Mr. Clift, of Birmingham, who was appointed the Engineer, put up some of his ovens. These were in use until about six years since, when they were pulled down and retorts erected in their stead. The ovens and a bench of retorts previously erected were worked side by side in winter time, but I much preferred the retorts, for I found the ovens lost a great deal of gas on the first charges, the quantity of fuel required was more than with retorts, the carbonizing wages were higher, and the small friable coke did not suit many of our customers.

The retorts now in use are the general setting of seven in a bed common in many gas-works. There is one oval retort over the fire, 21 in. by 15 in., and six 16-inch round ones; and from these retorts working with slack I have produced, on the average during the half year, 4000 cubic feet of gas per mouthpiece in 24 hours, and 20,000 feet per man in 12 hours.

About six years ago, when building a new retort-bench, I put settings in of through retorts, and charged with the scoop; but my experience is, so far, against throughs. When working with slack—for I found the retorts did not keep up their heat as well as with singles—through retorts being charged at both ends at the same time, there was a cold charge put in along the whole 20 feet length of retort, whereas with single retorts 10 feet is only charged, and those retorts can be charged which are opposite to the ones that are half spent, or have been working three hours; also I think the backs of the retorts do their share of carbonizing as well as the sides. I find besides that I can get better results from charging with the shovel than the scoop, and consequently have put the scoop on one side.

Much has been said from time to time about the dip in the hydraulic main, and I quite believe that if it could be safely dispensed with more gas would be made. As regards its influence in causing carbon to form on the insides of the retorts, I have observed when working with slack that it accrues quite as quickly on throughs as singles, also that ascension-pipes are more frequently stopped with throughs, with the disadvantage of having to lay off a 20-feet length of retort instead of a 10-feet, to get them unstopped.

During the "scare" about the electric light I heard the question asked as to how far the distillation of coal could be carried on so as to produce a profit irrespective of gas. Without answering this question, I may go so far as to state that I hope to show at some future time that the sale of the residuals can be made to pay for the coal or slack, and 9200 cubic feet of gas made to the ton. At present at Longton we have contracts against us for

slack and ammoniacal liquor, otherwise we should have been able to do it for this half year. As it is, however, you will observe from the statement on the table that the net cost of slack, &c., after deducting residuals, was 1s. 11·83d. per ton, and 2·90d. per 1000 cubic feet of gas sold.

I might here allude to the question of wages, which usually form the greatest item in the working expenses. While other trades have reduced their wages, gas companies and corporations have generally been contented to allow the wages of their *employés* to remain at the same or nearly the same rate as they were forced up to in the prosperous years of 1873 and 1874, when coal and the necessaries of life were considerably dearer than they are now. I may mention that at Longton the foremen stokers, who used to get 24s. per week about nine years ago, have advanced by degrees to 33s., and ordinary stokers from 22s. to 29s. per week. In the Longton Gas-Works, as in many works of the same size, foremen stokers look after the boiler, engine, exhauster, and pressure, and the labour is supposed to be worth 4s. per week more than that of the ordinary stoker. There is also a second stoker who has 2s. per week over the ordinary stoker, and who is supposed to assist the foreman stoker, and to be capable of taking his place if absent through illness or other cause. The wages now received by these classes of stokers are respectively 32s., 30s., and 28s. per week, they having been reduced during the last month by 1s. per week in each class.

I may add that during the half year the cost of slack, &c., as laid down in the retort-house, was 7s. 3·74d. per ton of coal carbonized, and 10·67d. per 1000 cubic feet of gas sold. The residuals made 5s. 3·91d. and 7·77d. respectively, leaving the net cost of coal 1s. 11·83d., and the cost per 1000 cubic feet of gas sold 2·90d. The labour for carbonizing was 3·28d.; and the wear and tear of retorts, 1·39d. The consumption of fuel was 39·24 per cent. of make; but this includes the carbonizing of 223 tons of shale, cannel, and common slack, which made little or no coke.

I have prepared a working statement of the results derived, from the half year to the 31st of December last, for the inspection of members, and should have liked to have presented the whole year's working up to June last, but could not get the rental, &c., made up in time, and in obedience to the wish of your President, I have done what I could with the materials at command.

Abstract from Statement of Accounts.

Gas made per ton	9174 cubic feet.
Gas sold per ton	8217 "
Coke used for fuel	39·27 per cent.
Cost per 1000 cubic feet of gas sold—	
Coal and slack	10·67d.
Stokers wages	3·28d.
Repairs and maintenance of works	1·71d.
Repairs and maintenance of retorts	1·39d.
Net receipts for residuals per 1000 feet of gas sold	7·77d.

Discussion.

Mr. PEATY (Burslem) said that if the illuminating power, as stated by Mr. Darwin, was tested by Sugg's No. 1 burner, it meant 12½ or 13 candles by the old burner as commonly employed in his district. He should be glad to know how much gas per ton of coal used Mr. Darwin could produce.

Mr. DARWIN replied that his estimated production was 9200 cubic feet from slack alone. He did not think it would be right to set down the illuminating power so low as 13 candles.

Mr. PEATY, resuming, said if coal could be obtained at 8s. 2d. per ton, the cost would average 10d. per 1000 feet, whereas the average in Mr. Darwin's case seemed to be more than that. Unless, therefore, there was a gain in the amount of tar and liquor produced, coal would seem to be quite as advantageous as slack to use for gas-making. He had noticed in his experience that better heats were maintained when coal was used than with coke obtained from slack. With burgy there was always a difficulty in maintaining a thoroughly good heat, inferior coke being the result.

Mr. DAVIS (Hereford) said perhaps Mr. Darwin was so placed that large coal was, in proportion to slack, far more expensive if he had to give the market price for it. From his experience with South Wales coal, he preferred the large to the small—he obtained better results from it. But perhaps he had been more fortunately placed than others, because those concerned in his works went in for large coal, and the only small coal he had to deal with was that made in carriage and storing. Some years ago, at Canterbury, he had used Newcastle coal which was much the same as what was called burgy in Lancashire, there being scarcely ever anything in it larger than nuts, and he had obtained good results from that coal—results as good, perhaps, as those he was getting at the present time from large coal. But it was a different class of coal, and caked more than the South Wales descriptions. When he commenced at Canterbury, however, he could not get 8000 cubic feet of gas to the ton; but that was accounted for by the fact that the retorts were in a very bad condition, so much so that it was not an unusual thing for him to use a barrow full of clay to stop holes in a retort before charging. But when the season allowed of his making a change in the state of things, he did so, and obtained 11,000 cubic feet to the ton; and he had been getting that from the South Wales coal, the illuminating power being 14 candles, with a Sugg burner. The question was, not if the gas was in the coal, but if they could get it out; and when they saw it going up the chimney there could be no question that it was being wasted. He did not see, however, why others should not get the same results as himself. The large coal, he might add, he had put into the upper retorts in lumps as large as a man could lift and throw to the end of the retort. By this plan he found that it was better carbonized, and that the results were altogether better, the gas escaping more readily from large lumps than from small. With respect to the question of through retorts, his retorts were built back to back, but he did not work them through, because to light up double settings would be more than he required. Scoops he could not use, because of the large coal. As to the dip, some had a dip of 3 or 4 inches, or even more; but he put up a large hydraulic of wrought iron, 22 inches in diameter, which worked 24 retorts. That allowed him to work with a small dip, and he set it to half an inch. With that he had no difficulty, except that it got out of level occasionally, but that was set right with a little trouble.

Mr. WINSTANLEY (Newcastle-under-Lyme) said that he was exceedingly interested in this matter, and asked for information as to Mr. Darwin's cost for wages per 1000 cubic feet of gas made. Taking slack at 6s. 10d. per ton, which was the price given by Mr. Darwin, he thought that if they could get burgy at 7s. 6d. or 8s. per ton it would pay them better to use it. He found, for instance, that with coal he could obtain a maximum production of 28,000 cubic feet of gas per man per day; whereas in Mr. Darwin's case it was 17,000 cubic feet, and his wages amounted to 2·34d. per 1000 feet, as against 3·50d. as shown by Mr. Darwin's accounts. Further than this, it seemed to him that the wear and tear account must be greater with slack than with coal, because of the smaller yield per ton. From coal he obtained an average of 9700 feet per ton. In reply to Mr. Darwin, he said that his retorts were 24 in. by 18 in., and 9 ft. 6 in. long inside, and that he worked eight-hour charges.

Mr. M'MILLAN (Stoke-upon-Trent) said that from the same seam that Mr. Winstanley was using—viz., the 7-feet Banbury—he was satisfied 9700 feet of gas per ton might be obtained, working with burgy. That was with 60 per cent. of slack and 40 per cent. of large coal. He had made several averages. For the first portion of the term he had taken, they were getting coal from a very good seam in the Harecastle Colliery, but, like other seams, it eventually depreciated; however, the average for the first four years was something like 9600 feet per ton, and he believed if the Banbury coal was properly picked of its impurities before delivery, its qualities for gas-making would be still better. For the past quarter the average make had been 9890 cubic feet per ton. The illuminating power was generally 15·20 or 15·30 candles by Sugg's "London" burner, no cannel whatever being used in the manufacture.

Mr. ANNAN (Wolverhampton) said that from what had come to his knowledge recently he was inclined to believe that slack might, with profit, be converted at the pit's mouth into coke, tar, and liquor, paying no heed whatever to the gas, but letting this escape into the clouds. The paper, he thought, was a very good one, and no doubt many of those present would see the usefulness of it, and would try to help forward that good time when gas-making would pay for the sake of the residuals, and gas would be given away to a grateful public.

The PRESIDENT inquired if the members had worked out the cost of manufacture to them, so as to form a comparison with the figures given by Mr. Darwin.

Mr. SIMPSON (Rugby) said that his net cost was 1s. 9½d. per 1000 feet, and he wanted 1s. 7½d. for dividend.

Mr. ANNAN said he believed his cost was nearly 1s. 5d., including distribution, and he required about 10d. for dividend.

Mr. TINDALL (Walsall) referred to the interest with which he had listened to the valuable paper just read, and said the results which Mr. Darwin had obtained from the use of slack were, in his opinion, exceedingly good. He had never used slack to any considerable extent, but he had tried it, and had found the make of gas to go down considerably. With South Yorkshire and Derbyshire coal his make was 9500 cubic feet per ton, taking the year round, and he was afraid he could not obtain the same results from the use of slack. The difference in price between slack and coal would be lost in labour and the quantity of gas made per ton. His experience was in favour of through retorts, both as regarded carbonizing and consumption of fuel. His dip was about the same as Mr. Darwin's. In the last bench of retorts he fitted up, he divided the hydraulic main, so that to each length there were two settings of seven retorts. He exhausted from four points instead of one at the end, and he found that to be a great advantage.

Mr. STORER (Stafford) said that for many years he had used nuts exclusively, and his average make last year, and, indeed, for some years, had been 9700 feet per ton. Through retorts in large works were, no doubt, the best; but in small works he maintained they were a disadvantage, occasioning inconvenience in lighting up and in letting down. In dealing with the average make per ton of coal, it was necessary to take into consideration the unaccounted-for gas. He knew there were men who boasted of obtaining a large yield of gas for the quantity of coal used; but, on the other side, they had a large quantity unaccounted for. He believed, however, that this would be well looked after by Mr. Darwin, who had put the matter very fairly before the meeting, and had candidly stated the small yield of gas per ton of slack used. He admitted that he could not use slack. With regard to the dip, he should advise that it be done away with. Some friends of his were working with dips, and others were working without them, and the results from the latter were something like 700 feet per ton better than from the former, whilst the average illuminating power was also very much increased. Another important item was the consumption of fuel. Mr. Tindall's fuel account would bear comparison with any, but he was sorry he did not know what Mr. Darwin's was, as it would have guided him in his calculations. He had been working with coal for the past week as an experiment, and he found that the heats were more regular than when nuts were used; but still his Committee had accepted tenders for nuts again, and he was not going to turn his back upon an old friend. In answer to the President, he added that he was using Madeley nuts, which might be reckoned as North Staffordshire coal, Madeley being just on the borders of Cheshire.

Mr. SIMPSON (Rugby) said that the conclusion to which experience had led him was that a good production could not be obtained from coal, nuts, or slack, unless there was a good heat. He did not bind himself to supply 17-candle gas, but he did it; and he thought he could do so with either nuts or slack, if he was not pressed for quantity; but he could not get up to his brother manager's quantity per ton. He tried it one year, but it brought so many complaints that he gave it up, went back to the old practice, and produced 17-candle gas, going up to 18. Nuts were cheaper than coal, and 1s. a ton was worthy of their observation; and if he had good nuts he could make that 1s. a ton a little better for the Company than if he bought coal. Slack he had not tried, but he thoroughly believed that if he had not to put so much coal in and work it off, slack would pay him even better. If, however, he were to use slack, he would have to adapt his retorts to it, as a retort fixed for coal would not do for slack, because there must be an intense fire. Whilst he could not compare with his friends near him as to quantity, as to general results he did not fear to compare with them, for if they gained in one thing they lost in another, and by an interchange of opinions they would find that what did not suit in one town suited in another.

Mr. DARWIN, replying to the discussion, alluded to Mr. Peaty's remarks as to illuminating power, and said that his paper showed that he had no difficulty in maintaining a standard of 15 candles, and sometimes he went above that. As far as results went, and taking the residuals into account, he believed they would compare favourably with those of Mr. Peaty. He (Mr. Darwin) was at a disadvantage as regarded carriage, inasmuch as he believed it was 1s. per ton more to Longton than to Burslem, and he had, besides, to pay 1s. per ton above the market price for slack, under a contract which, however, would happily soon terminate. As he had stated, the net cost for slack, &c., per 1000 cubic feet of gas sold was 2·90d. and 1s. 11·83d. per ton carbonized; and he believed that if he had the advantage of the market price of slack and ammoniacal liquor during the half year, he could have paid for the slack out of the residuals. Mr. Davis had mentioned the large amount of gas he made per ton, but possibly he had to pay a comparatively larger price for it, and the proportion of residuals would be smaller. When he (Mr. Darwin) used coal, he generally charged his bottom retort with it. The dip he used was 1½ inches. Mr. Winstanley had said that his cost for carbonizing wages was 2·34 per 1000 cubic feet. His (Mr. Darwin's) was 3·28 per 1000 cubic feet, but Mr. Winstanley had introduced settings of six retorts of large diameter, and made each of the men carbonize 3 tons of coal per day, whereas he believed the usual quantity carbonized in the other Potteries towns was 2½ tons per man. His (Mr. Darwin's) wages also included a portion of those of a yard foreman, which possibly Mr. Winstanley's did not. Good clean slack could now, he believed, be had at 3s. 6d. per ton at the pit. [A VOICE: 3s.] He doubted whether a good quality could be maintained at 3s., so as to have it good when it was most wanted—viz., in winter. Mr. M'Millan had said that he specified burgy to be 40 per cent. of coal and

60 per cent. of slack, which very nearly agreed with what he (Mr. Darwin) had stated in his paper.

The PRESIDENT said that he was sure all present would agree with him that the subject they had under consideration was one of great importance, and that it had been dealt with very fairly by Mr. Darwin. At the same time, the question of the comparative economy of slack and coal was one that was very difficult to determine, for this reason, that they could not easily get a comparison based upon precisely the same terms. He agreed with many of the speakers as to their experience of the use of slack and nuts. He had found that they caused the heats to go down, and altogether such good results were not obtained with them as with coal. But then the position of the works had to be taken into account. If the works were situated, say, 100 miles from the collieries, it certainly was well to get as much as possible from the coal, because then the question of carriage came in—the cost of transport being as much for coal that produced only 8000 or 9000 cubic feet per ton as for coal producing 10,000 or 11,000 cubic feet per ton, so that their friends who were nearer the pit's mouth might find it profitable to use slack, while they at a distance found that the cost of carriage outweighed any other advantage they might obtain. With regard to the question of sulphur in the gas, he could hardly agree with Mr. Darwin that the amount was influenced by his method of carbonizing, nor could he agree with that eminent engineer, whoever he might be, quoted by Mr. Darwin, who considered that by limiting his production per ton he retained the sulphur in the coke, instead of allowing it to pass off with the gas. So far as he was aware, no one had yet been able to discover the precise conditions favourable to the formation of bisulphide of carbon; but happily, of late years, their knowledge as to how it was to be got rid of had considerably increased. One way by which it could be very much reduced was by thorough washing—making use for this purpose of the whole of the ammonia produced both in the condensers and in the scrubbers. That was a profitable operation, and one that should be carried out with completeness in all gas-works. Mr. Darwin had touched upon many matters which might be called controversial, since they had from time to time been productive of no little discussion, and might be expected to continue to interest them. The question of ovens *versus* retorts they had before them twelve months ago. As to short or through retorts, that was purely a question of convenience. He was aware that equally good results were obtained with the one as with the other, but he maintained that when the works were sufficiently large, through retorts were much to be preferred. Mr. Storer had raised the question of the expediency of the dips. It was one that seemed to be coming to the front, having received increased attention of late years. Mr. Davis had shown that with a very shallow seal excellent results could be obtained. What was wanted was to relieve the retorts from pressure, and perhaps it mattered little how that was done, but for his part he preferred to do without the dip. He had said that slack and nuts required greater heat to carbonize, and that, he thought, agreed with the experience of Mr. Darwin himself, whose fuel account amounted to 39 per cent. Mr. Darwin had explained that this was partly accounted for by the use of some cannel coal producing no coke; but taking it to be nominally 32 per cent., this was about 6 per cent. higher than the average, and this excess he was inclined to attribute to the slack. The discussion, he thought, had shown the importance of endeavouring to obtain information bearing upon the different localities in which they carried on their operations. Much information had been afforded them with reference to one coal-field—viz., that of North Staffordshire, and if they could follow it up by a discussion relating to other coal-fields, such as the Derbyshire, it could not fail to be of service to them. He proposed a very cordial vote of thanks to Mr. Darwin for his paper, coupled with a request to him to allow it to be printed and circulated amongst the members.

Mr. WINSTANLEY seconded the proposition, which was unanimously agreed to.

Mr. DARWIN, in responding, said that he had taken great interest in this question of working slack, and generally he had found the results very satisfactory. The balance-sheet of his Company would compare very favourably with those of many other companies in other towns.

A vote of thanks to the President was then, on the motion of Mr. STORER, carried unanimously.

The PRESIDENT, in acknowledging the vote, announced that at the next meeting, to be held in October, Mr. Annan had kindly undertaken to introduce the subject of condensation; and that Messrs. Winstanley and Peaty had promised to furnish an account of their recent visit to Paisley, for the purpose of inspecting the patented process of Mr. Hislop for the revivification of lime.

ST. JOHN'S GAS COMPANY.—This Company was registered on the 18th ult., with a capital of £35,000, in £10 shares, with power to increase. The Company proposes, upon terms of an unregistered agreement of the 1st of January last, to purchase certain gas-works at St. John's, in the island of Porto Rico, and certain properties, plant, and effects used for the same, and the concession under which the works are carried on. The number of Directors is not to be less than three nor more than seven. The Subscribers are to appoint the first, and subsequent Directors are to hold shares or stock to the nominal value of £500. The Company in general meeting will determine their remuneration; but until the payment of 5 per cent. dividend, the remuneration is not to exceed £1 1s. to each Director for every meeting attended, together with expenses. Mr. George Bower is appointed Managing Director.

FATAL FIRE THROUGH AN ALLEGED ESCAPE OF GAS.—Last Wednesday an adjourned inquest was held into the circumstances attending the death of Letitia Banks and Olive Ann Banks, the wife and daughter of Mr. Alfred William Banks, india-rubber goods manufacturer, lately residing at 13½, Aldersgate Street, London, who met their deaths by suffocation and burning on the morning of the 23rd ult. General evidence as to the fire having been given, Mr. Banks was called, and said there were 10 gas-burners in the shop window, and a light over the cutting-board at the back of the shop. The gas-pipes supplying those burners came from the gas-meter underneath the store-board. It was connected by a composition pipe, which was continued along the wall to the light over his desk. The burners in the front part had not been lighted for over two months. In reply to a Juryman, who remarked that he had known composition pipes to be eaten away by vermin, witness said there were no rats beneath the shop rafters. Mr. Edwin Browning, a gas inspector, was of opinion that the fire broke out at the gas-jet over the desk, caused by an escape of gas, which ignited and set fire to the ceiling. There must have been a large body of flame. He believed the composition pipe melted, and the flame reaching the service-pipe, increased the fire. The Coroner, in the course of his remarks in summing up, said that to have a gas-burner constantly alight without a guard was most dangerous. The Jury returned a verdict of "Accidental death," but recorded their opinion that gas companies should have more control over the means of lighting; for had the burners in question been protected, this unfortunate calamity would never have happened. The Coroner said that he entirely agreed with this expression of the jury.

WARRINGTON CORPORATION GAS SUPPLY.

The following is the Gas-Works Revenue or Profit and Loss Account of the Warrington Corporation, for the nine months ended March 25, 1879:—

Expenditure.

Stock on hand, June 30, 1877					£1,959 6 11
Sundries, viz.:—					
Wages for gas manufacture			£1,649 11 4		
Repairs, brickwork			203 19 3		
Repairs, ironwork			445 15 3		
Cannel and coal			5,993 5 7		
Lime, purifying materials, and wages			425 1 0		
Water			103 8 7		
Retorts and fire-bricks			253 14 7		
Meter inspection and repairs			237 13 10		
Lamps and repairs			54 6 6		
Lamplighting			342 5 9		
Salaries			754 19 6		
Rates and taxes			1,517 7 10		
Office expenses			131 7 0		
Fittings			819 15 0		
Repairs to cottages			11 8 6		
Rates on cottages			42 8 9		
General expenses			175 18 2		
Stock purchases:—					
Main-pipes (see *contra*)		£826 12 2			
Relaying main to Wilderspool		40 0 0			
			866 12 2		
Annuities and interest on loans			3,173 2 6		
					17,204 1 1
Discounts (estimated)—					
Oct. 25, 1878			£741 16 10		
March 25, 1879			1,672 8 8		
					2,414 5 6
Bank commission					16 18 2
Balance			£5,784 17 10		5,784 17 10
Less three months annuities and interest			1,580 0 0		
Net profits			£4,204 17 10		
					£27,379 9 6

Receipts.

Gas sales and meter-rentals	£19,360 19 2
Fittings sold	884 5 11
Coke sold	1,126 3 8
Tar sold	1,324 14 4
Ammonia sold	901 16 8
Lime sold	190 14 9
Sundries sold	188 18 2½
Capital expenditure (see *contra*)	826 12 2
Cottage rents	189 18 9
Balance of discounts, &c., reserved to June 30, 1878	67 14 10½
Stock in hand, March 25, 1879	2,317 11 0
	£27,379 9 6

ANALYSES OF THE WATERS OF LAKE THIRLMERE AND THE RIVER VYRNWY, THE NEW SOURCES OF WATER SUPPLY FOR MANCHESTER AND LIVERPOOL.

By Mr. C. ESTCOURT, F.C.S.

[From the *Chemical News*.]

In December, 1877, I visited Lake Thirlmere, and took samples of the water, one at the head of the lake, and one at its present outlet. I had intended visiting the lake during the ensuing summer, for the purpose of observing the difference between the two seasons, but circumstances prevented me from carrying out this intention.

I find that since then Messrs. Grimshaw have analyzed samples taken about the end of the summer of last year (namely, August, 1878),* and it will probably not be uninteresting to compare the results of the analyses of the winter and summer samples with each other.

During the present summer I visited the River Vyrnwy, at Llanywdden, in Montgomeryshire, at which place the river is for four miles to be converted into a lake for the purpose of supplying water to Liverpool. I procured a sample of the water at a spot within the area of the intended lake. The following are the results of my analyses, together with those of Messrs. Grimshaw, of Thirlmere:—

Per Gallon.	Thirlmere Water Unfiltered.				Vyrnwy Filtered.
	Estcourt. Head of Lake.	Grimshaw. Upper.	Estcourt. Outlet.	Grimshaw. Lower.	Estcourt.
Total solid matter	2·25	2·20	3·10	3·15	5·16
Mineral matter	1·10	1·50	1·15	1·40	1·46
Loss on ignition	1·15	0·70	1·95	1·75	3·70
Hardness, all permanent	2·25	1·00	1·50	1·00	2·75
Chlorine	0·58	0·42	0·44	0·70	0·41
Ureal ammonia	—	—	0·0009	0·0021	0·0154
Albumenoid ammonia	—	—	0·0042	0·0042	0·0056
Colour	None.	—	None.	—	Pale yellow.

It will be perceived that all analyses of Thirlmere water gave results within the limits of extreme purity. The difference in the degree of hardness, shown in the analyses of Messrs. Grimshaw and myself, may arise from the use of a different standard solution. 1 c.c. of the soap solution used in my laboratory is required to produce a lather when 70 c.c. distilled water are shaken with it. Thus the hardness in my samples due to mineral matter will be 1·25° and 0·50° respectively.

In the Vyrnwy water the amount of organic matter which it contains is indicated readily by its peaty colour, and it will be observed the ureal ammonia is high. The unfiltered water contained brownish floating particles, which could not be got rid of by decantation, therefore filtration was necessary. After the filtered water had been standing for a fortnight, the colour had not diminished in depth.

THE PRESTON GAS COMPANY'S BILL.—At the last meeting of the Parliamentary Committee of the Preston Town Council it was reported that the terms of arrangement with the Preston Gas Company, with reference to their Bill, were the prohibition of the site of Appleton Row for the storeage of gas; the additional capital to be reduced from £160,000 to £120,000, inclusive of premium; the borrowing powers from £40,000 to £30,000; that the proposed extension of limits be confined to Broughton; and that the notice to be given to the Company before testing the pressure of the gas be "reasonable notice," instead of "two hours."

---

* See JOURNAL, Vol. XXXII., p. 788.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

(*Continued from page* 183.)

Mr. D. Bruce Peebles (Edinburgh), after reading the Auditor's report which was most satisfactory and was unanimously approved of, made the following remarks on

THE NEEDLE GOVERNOR, Etc.

I beg to be allowed to state that I intended to read a short paper to-day, but having been from home for some time past, the date of the meeting slipped from my memory, and I was too late in sending the title of the paper to the Secretary, he having sent out the notices of the meeting before he heard from me. Instead of giving a paper, therefore, I would simply ask you to allow me to make one or two experiments, which, I think, will interest you, although I should be sorry to interfere with the programme, or disturb the order of the proceedings in any way, without your permission.

I may explain that I had the honour, some time ago, of reading a paper before the Royal Scottish Society of Arts here, the subject being "The Needle Governor in connection with Gas Illumination." Several members of that Society, who are also members of this Association, desired me to take this opportunity of bringing the matter before you to-day, as being interesting and instructive in connection with the development of the illuminating power of coal gas; and seeing that our esteemed member, Mr. Young, has chosen a subject in which that point will play a very important part, I should be glad if he had an opportunity of seeing these experiments before he reads his paper, and if you see them and he sees them, he may or may not, in a certain degree, modify some of the ideas regarding the carbon element he is to bring before us in connection with the illuminating power, and you may be better able to discuss what I am sure will be a most interesting paper.

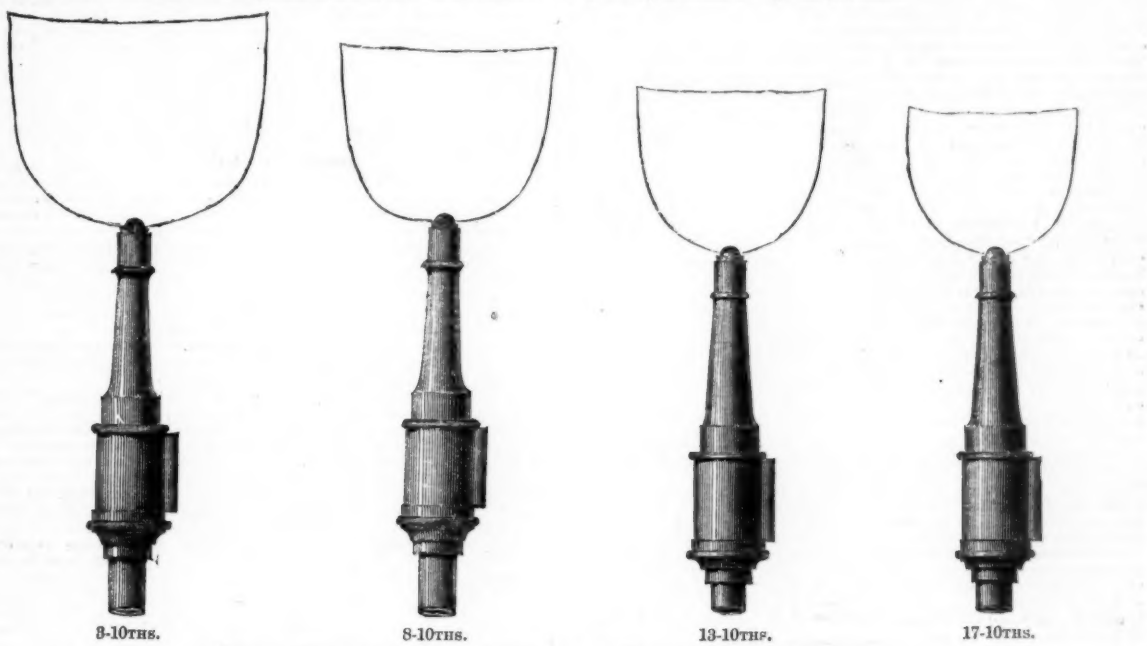
The first thing I wish to show you is a simple arrangement by which two rat-tail burners may be made to come together, so that the flames may coalesce and form a union jet, which arrangement may be useful to any of you who may be giving lectures, &c., and may wish to show how two long flames may be made to change their shape and combine to form a compact shapely flame having a much greater illuminating power. The apparatus is easily made by filing down two union jet burners in the direction of their axes, until only one of the small holes is left; then forming each burner into a half tube and making them work on a pivot, so that the holes can be separated or brought opposite to one another with certainty. When brought together we notice that we have the union jet produced, with a great increase of light from the same quantity of gas.

The next experiment is the bringing together of two small union jet flames, and we see that the moment they are brought in contact there is a great increase in the illuminating power. I am inclined to think that the cause of this increase in the illuminating power is that when the flames are separate there are four sides exposed to the cooling influence of the air. When brought together there are only two sides thus exposed. Less oxygen, therefore, is supplied to the hydrogen, and more carbon is liberated, which, being raised to whiteness by the increased temperature, gives a corresponding increase in the illuminating power.

What I wish to bring more particularly before you, and to show you by experiment, is the great loss of light when the pressure at the burner is increased. Dr. Wallace, Dr. Macadam, Mr. Stewart of Greenock, and Mr. Mitchell of the Dundee Gas-Works, have made experiments in connection with this, and tabulated the results, which prove conclusively that gas should be burned at a low pressure. The paper read by Mr. Mitchell last year at St. Andrews may be fresh in the minds of many of you here, and I have selected his table because he adopted a certain stated delivery of gas per hour as the basis of his experiments. Here is Mr. Mitchell's table giving the results of burning 5 cubic feet of gas at different pressures:—

5 cub. ft. of gas gave at	0·3	pressure	21·97	candles	illuminating	power.
"	"	0·8	"	21·97	"	"	"
"	"	1·1	"	17·17	"	"	"
"	"	1·7	"	11·16	"	"	"

The only difficulty in making this experiment lies in getting a burner of the exact size to pass the exact quantity at the given pressure, and then to be sure that that pressure is maintained. By a number of trials of different sized burners from one maker, I succeeded in getting the exact quantity at a given pressure, and by the aid of the needle governor I had no difficulty in maintaining that pressure.



3-10ths. 8-10ths. 13-10ths. 17-10ths.

Uniform Consumption of Five Cubic Feet per Hour, at Varying Pressures.

We have here four needle governors, with different sized burners set to the pressures at the point of ignition given in Mr. Mitchell's table. The first burner delivers the gas at 3-10ths pressure, the second at 8-10ths, the third at 13-10ths, the fourth at 17-10ths, and each of them passes exactly 5 cubic feet per hour. I now light them, and you will at once see that the light decreases as the pressure is increased, and to such an extent that when I saw this for the first time, I would not believe that the fourth burner was really passing 5 feet per hour, and it was only after I again and again tested each burner, and the rate per hour, that I was convinced.

The results are so startling that I think if the public could only see the experiment as we see it here, it would lead to a revolution in gas lighting, and save many complaints about bad gas. With the photometer the results are quite as convincing as these, but they are open to doubt by those who do not understand that method of taking the illuminating power. With the four lights burning simultaneously, the first giving a full, beautiful, rich, powerful flame, the second and third decreasing in power, while the fourth has a thin white and feeble flame, all doubt as to the deteriorating effects of high pressure is dispelled, although we can hardly imagine that the same gas is being burned, and we can understand that a consumer burning the gas under conditions similar to the first burner, would naturally say, "What splendid gas our company gives us!" while a consumer burning gas in a manner similar to that shown with the fourth burner would be likely to say, "What wretched gas our company gives us!" the gas in each case being of the same illuminating power.

No more striking proof of the manner in which gas is absolutely wasted, and its illuminating power destroyed, could, I think, be given, and I am glad that through the courtesy of the President and your good-will I have had the opportunity of bringing the subject before you to-day. I hope some discussion will follow, as it a matter in which we are all more or less interested.

Discussion.

Mr. J. Mayer (Glasgow): Seeing there is a difference in the luminosity of the flames, I should like to know if the carbon in each case is perfectly consumed, or if a marble slab were to be held over the flames would there be a deposit on any of them, and, if so, which would show the greatest amount of unconsumed carbon?

Mr. Peebles: I should say that the one burning at the lowest pressure would have the greatest tendency to deposit carbon, simply because that flame is nearest the smoking point. With ordinary English coal gas the difference between the flames would be more apparent than it is here, because with cannel gas of 28-candle power we can afford to use a higher pressure without losing light. When we come to gas of 14 or 15 candle power, the loss of light by the increase of a few tenths pressure is much greater and more noticeable, but even with our rich cannel gas the result of increasing the pressure only 14-10ths is sufficiently startling, destroying, as it does, above 50 per cent. of the light, as shown by Mr. Mitchell's table, and conclusively proved by the experiments now made. Dr. Macadam's theory is that when gas is burned the hydrogen unites with the oxygen and liberates the carbon. The hydrogen and oxygen burn with a feebly luminous but powerfully heating flame, which raises the free carbon to a white heat, and gives us our brilliant gaslight.

Mr. A. Macpherson (Kirkcaldy): If I understand Dr. Macadam's theory, it was that the carbon with the 17-10ths pressure was not consumed but passed off. If this is the case, there must be a great deposit of carbon which cannot be utilized as light.

Mr. Peebles: If you bring a cold slab down upon a flame, you reduce the temperature, and by thus stopping the combustion of the carbon you get it deposited.

Mr. Macpherson: I understood that the slab was to be held over the flame at the same level in each case.

Mr. Peebles: The only effect of bringing the slab down would be to cool the flame, and the carbon burning at the low pressure would be more readily cooled than that at the high pressure, which is partly burned as a gas.

Mr. J. M'Gillivray (Penicuik): Where does the carbon go to? If it is collected on the slab from a burner at low pressure, and escapes in the other, it is not burned, and it is not collected. Where does it go to?

Mr. Peebles: Dr. Macadam's explanation answers your question. In the one case the hydrogen and carbon do not separate, but are burned as a gas, there being a full supply of air; in the other case, the hydrogen leaves the carbon, which, being heated to whiteness by the burning of the hydrogen and oxygen, gives us the light.

Mr. Macpherson: Is there a new gas formed in that flame.

Mr. Peebles: Certainly not.

Mr. Macpherson: Am I to understand that oxygen and air combined with carbon form a new gas?

Mr. PEEBLES: If you mix air with the gas, the flame would approach more or less closely to what we see with the blowpipe. I did not, however, come here to theorize, but to show practically the enormous amount of light which is lost by burning gas at a high pressure. Theory tells us that when coal gas is liberated from the burner and a light applied, the hydrogen liking oxygen better than it does carbon, leaves the one for the other, and I think Dr. Macadam gave a very clear and satisfactory explanation of this. Mr. Carter also, at the same meeting, expressed himself very felicitously when he stated that at high pressures the gas is consumed without going through the middle state—the purgatory of becoming incandescent.

Mr. W. YOUNG (Clippens): I do not think that this matter of the difference of combustion can be made much plainer, for I think Dr. Macadam has explained the subject as clearly as it is possible to state it. At ordinary atmospheric pressures, to obtain light from a flame it is necessary that the heat should act upon some solid matters. Now, the carbon present in coal gases is in the gaseous form, and before it can produce light it is necessary that it should assume the solid form, or pass into soot, and whilst in that state be made incandescent. We know that it is quite possible to burn a hydrocarbon gas without the carbon ever assuming the solid form—as, for instance, in the Bunsen burner, where an abundant supply of oxygen being provided, both the hydrogen and the carbon of the compound gas simultaneously combine with the oxygen, and the carbon is burned in the gaseous state, and consequently without incandescence or light; but if we close the holes for the admission of air in the Bunsen, and thus limit the quantity of oxygen, the carbon is no longer consumed directly as gas, but for a limited time is in the solid state, or "purgatorial" condition referred to by Mr. Peebles, and in this state we can remove it from the flame by arresting the combustion with a cold surface depressed over the flame. The carbon cannot be so removed from the flame of the Bunsen, which gives no light, for in it the carbon never assumes the solid state. We have also an excellent illustration of the combustion of a compound hydrocarbon in the manufacture of lamp-black. There the current of air admitted to the chamber in which the hydrocarbon is consumed is just sufficient to burn out or combine with the hydrogen, the carbon passing on to the precipitating chamber in a black cloud of finely-divided solid carbon or soot. The admission of a large quantity of air would lead to the combustion of the whole constituents of the hydrocarbon employed to make the lamp-black. Now, in each of those four burners shown to us by Mr. Peebles, the same quantity of hydrocarbon gas is being consumed, and all are ultimately combined with the same quantity of oxygen, and there is substantially in all the cases perfect combustion, no unconsumed carbon escaping; but they, nevertheless, give different amounts of light, due to the fact that the mode of combustion is in each case different. In the burner consuming the gas at the high pressure, we can easily conceive that the molecules of which the gas is composed, as they issue in the compressed state from the orifice of the burner, recoil from each other, and are thereby violently commingled with the surrounding air, and that the air thus entangled between the molecules of the gas leads to the simultaneous combustion of both the hydrogen and a portion of the carbon, and that portion of the carbon is consumed in the gaseous state, and therefore without passing through the "purgatorial" or incandescent state; and of course the greater the pressure on the gas at the point of issue through the burner, the greater will be the amount of the carbon so consumed, in consequence of the greater commingling of the air due to the recoil of the molecules. In the case of the burner consuming the gas at low pressure, the conditions are changed. The recoil of the molecules of the gas has taken place inside the little needle governor, and in an atmosphere of the gas itself. The molecules of gas therefore issue through the orifice of the burner in a steady stream, and there being no violent commingling of the air with the gas, the combustion of the gas must proceed from the external portion of the gas, so to speak, inward; but the hydrogen, under such circumstances, having a stronger affinity for the oxygen than the carbon, it is first consumed, and the carbon is liberated as soot. The intense heat of the external shell of burning gas tends to the decomposition of the hydrocarbons in the centre of the flame, leading to a further deposit of soot or solid matter. These solid matters are for a time kept in an incandescent state, and of course produce light. The carbon is only consumed when it passes to the upper portion of the flame, where the hydrogen is already consumed, and the oxygen of the air comes into contact with it. The paper with which I propose supplementing the remarks of Mr. Peebles will bring before you another phase of this subject, and will show you that it depends both upon the constitution of a gas and how it is consumed, as to what is the amount of light developed in proportion to the carbon present in the gas. There is no doubt that had Mr. Peebles employed, instead of 28 or 30-candle gas, gas of 15-candle power, the differences in the amount of light would have been still greater, for the smaller quantity of carbon present in a poor gas requires a smaller quantity of oxygen to lead to its combustion in the gaseous state. I believe that with the 17-10ths pressure at the point of ignition, the commingling of the air would be so great that the illuminating power of the 15-candle gas would be almost destroyed. There are no carbon particles passing away from the flames we see before us. Combustion is perfect in all four burners—viewing combustion from a heat point of view only; but there is only one (that at the low pressure) consuming the gas in such a way as to give the maximum amount of light. There the combustion of the constituents of the gas is not simultaneous, but the combustion is taking place in successive stages, the hydrogen, from superior affinity for oxygen, being first consumed, leaving a portion of the carbon as soot; the hydrocarbon present being also decomposed, and the carbon set free in the solid state. This liberated carbon is not at once consumed, but is kept incandescent for a time by the burning gases, and thereby gives light, and it is only finally consumed in the upper portion of the flame when it comes into free contact with the oxygen of the air.

Mr. J. REID (Leith): The discussion has developed into the chemical changes in these two burners, and to all gas managers this has been a very important discussion. We learn from it how the best results in lighting can be brought about by the use of a given quantity of gas. We have, as Mr. Peebles has shown, 5 cubic feet of gas per hour passing through each of these burners. It is manifest the light given by the low-pressure burner is very much greater than the other. We are living in an age when the motto of gas manufacturers may be expressed by, "More Light." More light seems to be the subject of inquiry in the various departments in which light has been searched for. When Mr. James Young, within the last 30 years, first brought paraffin oil to the market, he knew, as a chemist, that it contained great luminosity if properly used; but there was great difficulty in contriving any kind of appliance by which the best lighting results could, with perfect safety, be obtained from the paraffin oil. Mr. Young applied his ingenious mind to the problem of devising the cheapest necessary lamps. We have now very excellent lamps employed for consuming paraffin oil. With respect to the electric lamp, a great advance has recently been made, by an ingenious Russian gentleman, who has greatly improved the candle arrangement, and mode of equalizing the rate of consumption of the two carbons between the points at which the electric light is developed. This is a step in the right direction—to find out how the greatest good can be obtained from the electric light. We have for three-quarters of a century been accustomed to employ gas light. It has become a very common mode of lighting, and really up to the present time there does not seem to have been anything to stimulate Mr. Peebles and other engineers to find out the instruments to obtain the best possible results from the coal. I think that the instrument which we have just seen in operation attains the object very well. It seems to me to be most complete. We have here a means of controlling and ensuring constancy of pressure at the burner, whatever may be the fluctuations of pressure in the pipes from the gasholder. Indeed, altogether it puts into the hands of gas companies and gas consumers the means of getting the maximum amount of value in light from the gas with which they are supplied. I had the pleasure of hearing Mr. Peebles in this room when he read a paper on this subject before another Society, and I may state that the feelings of that Society were very much on the lines in which I have endeavoured to express my own now. I think we should accord to Mr. Peebles the best thanks of the Association.

Mr. MITCHELL (Dundee): I am sure we are obliged to Mr. Peebles for making the experiments which we have all witnessed on the results which I gave in my paper last year at St. Andrew's. I made these tests one after the other with the photometer. I gave the results, but I had not the apparatus to show the experiments as Mr. Peebles has done. I do not think he could have done it more conclusively, independent of theory altogether. Any one of the general public might see at a glance the improved light which is obtained by burning at a low pressure. With respect to the placing of a marble slab at a certain distance from the flame, I have no doubt there would be a little deposit of carbon, if the slab were held very near to the light which was burning at the lowest pressure, from the fact that the slab would exclude the air, and cool the incandescent carbon. But that need not stand in our way in advocating the burning of gas at a low pressure. If we sell 26-candle gas, we ought to advocate that the public will get 26-candle light out of the gas, if they will only make a proper use of it. At the same time, if there is a ceiling of great value in the room, and at no great distance from the gas-jets, and there is a likelihood, if the gas is burned at a low pressure, of destroying the ceiling, it is just a matter of expense whether they shall burn the gas at a little higher pressure, and thus obviate the necessity of destroying the ceiling. At the same time, the destruction of the gas by burning it at a high pressure is common in every town, and I think we ought, on principle, to advocate that it should be burned at a low pressure. Mr. Peebles has shown us how the illuminating power is increased by bringing two lights together, and I may mention that at a small exhibition of gas apparatus in Dundee during the past winter we arranged two lights in such a way that any one could bring the two jets together, and the general public could see the benefit of increased light. I have formed the opinion, both from theory and practice, that the increased light is due to this, that if, say, the lights are both burning at 9-10ths pressure, by bringing the two together the pressure is just reduced, and we have the better effect.

Mr. G. R. HISLOP (Paisley): I wish to refer in a word or two to the extraordinary difference which we have witnessed here when burning gas under different pressures, and to say what my experience is in endeavouring to remedy that which is, no doubt, the experience of all of you. The inspectors of meters in Paisley are allowed to sell burners to the consumers, and I find a great difficulty indeed in getting the public to take burners of the size which I think will develop the best results from the gas supplied. There is an extraordinary prejudice on the part of the public. They imagine that if you sell them a burner of a large size, this is only done with the object of increasing the gas bill. However, that little burner which Mr. Peebles exhibits overcomes the difficulty. If we were to supply to the consumer a burner such as that, we could ensure that the gas would be consumed at the proper pressure, and that the highest possible illuminating power would be obtained from the gas.

Mr. J. M'GILCHRIST (Dumbarton): I have to thank Mr. Peebles for exhibiting this instrument, and Mr. Mayer for introducing this discussion, which I think has been invaluable. Mr. Mitchell, of Dundee, has referred to the difference of pressure at which the gas can be consumed without producing smoke or carbon. I fully appreciate the remarks which he has made in regard to low pressure, and it is on his principle that the burner-man succeeds in disposing of his burners. He goes when the pressure is low at the gas-works, and, of course, when there is a low pressure at the consumer's meter, and placing a small porcelain slab over the flame, carbon is deposited in consequence of the burner being adapted to the night pressure. He then says, "Look at my burner," and he puts in a smaller burner, which has no appliance for reducing the high night pressure, and therefore increases the pressure at the point of ignition, and consumes the carbon. Then, when the pressure is changed at night, the consumer finds that the change has been a snare and a delusion, for his gas is then over-consumed, in the way Mr. Peebles has shown.

Mr. REID: I should like to put a question suggested by Mr. Mitchell's remarks. Can you tell us whether the same amount of gas is consumed when these two jets are apart as when they are in contact?

Mr. PEEBLES: I have not tested that; but I will endeavour to make the experiment. I am much obliged for the remarks that have been made upon these experiments, and for the kind way in which they have been received. In regard to Mr. Reid's last question, I may say that the President of the Society of Arts asked whether I had tried to boil a pint of water over the two lights burning at different pressures to see which had the greater heat. I am inclined to agree with Mr. Hartley, of London, who has long held that you get as much heat out of gas burned in the ordinary way as with a Bunsen burner. Talking of that to a student who was at Heidelberg under Professor Bunsen, I was told that he never allowed the students to work with a pure blue flame having a perfect cone—he always insisted on some of the yellow flame being present. While, possibly, for many purposes, we have a better and more serviceable heat by a Bunsen burner, yet in order to get the blue smokeless flame we have to mix the gas with a large proportion of common air, and in doing so we reduce the temperature. I will keep the questions in mind, and make the experiments indicated.

The PRESIDENT: I may state that I express the opinion of all when I say we are much obliged to Mr. Peebles for bringing this subject before us.

Mr. YOUNG read a paper

ON THE PROPORTION OF CARBON PRESENT IN GAS IN RELATION TO ITS ILLUMINATING POWER.

At the last annual meeting of this Association, Mr. Macpherson, of Kirkcaldy, read a most interesting paper on the relative modes of testing the illuminating power of coal gas. This was, in a sense, a supplement to another equally interesting paper on the relation between the condensation by bromine, durability, and illuminating power of coal gas as shown by the photometer, which the same gentleman read at a previous meeting. In my opinion these papers have not received the careful attention which they deserve, nor have they yet undergone the investigation and discussion necessary to eliminate the truth; and I propose, therefore, with the sanction of the Committee, again to draw your attention shortly to the subject.

While premising my remarks with the admission that in the majority of cases, when gases from coal are manufactured under similar con-

ditions, there is practically an approach to a fixed relation between the hydrocarbons removed by bromine, the durability of a cubic foot when burned by a 5-inch flame, and the illuminating power as ascertained by the photometer, I am yet of opinion that that circumstance is more a matter of accidental occurrence than an essential condition attached to the constituents which go to form illuminating gas. That is to say, were we to alter the mode of manufacture, and bring about a different arrangement of the elements, all the relative conditions would also be altered.

In order to illustrate my subject, I have prepared five different gases which contain the same number of atoms of carbon and hydrogen, but which, as you will afterwards observe, occupy different volumes, have different specific gravities, different durabilities, and very different illuminating powers. These gases are all present in variable proportions in coal gas, and as regards the quantity of each present in the gas, are all more or less dependent upon the mode of manufacture. I have selected these gases, as they show in the most exaggerated form the differences due to the structure of a gas in relation to its constituents.

This first vessel contains 1200 cubic inches of marsh gas (CH_4), which may be taken as representing 600 molecules or 600 carbon atoms combined with 2400 hydrogen atoms. Therefore 25 per cent. of the total volume of this gas is carbon vapour, and yet you see that when consumed it gives but a very feeble light; in fact, you would pronounce the flame to be non-luminous.

But were the same number of carbon and hydrogen atoms re-arranged under modified conditions to form a more complex paraffin, we should have 100 molecules of C_6H_{14}, which would give 200 volumes, and would contain all the 600 atoms of carbon combined with 1400 atoms of hydrogen. There would, therefore, be 1000 hydrogen atoms set free, which would form 500 molecules, and occupy 1000 volumes, which, added to the 200 volumes of C_6H_{14}, equals 1200 volumes, or the same volume as when all the atoms were combined in marsh gas.

I have here another vessel containing such a mixed gas, which, as you can observe, possesses the same volume as the last; but the alteration of structure, although not changing the volume and specific gravity of the gas, and therefore the durability of the flow of the gas through a given sized orifice, yet very materially affects the illuminating power, for on lighting this gas you see that it burns with considerable luminosity. Another characteristic of this illuminating gas is that the illuminants consist wholly of paraffins, of which bromine would not remove a trace, or, in other words, there would be no condensation by bromine. This third vessel contains another mixed gas, and, as you will observe, it is considerably larger than the two first; yet although this is the case, it contains exactly the same number of carbon and hydrogen atoms as in the two other cases, only they are differently arranged or grouped together. We have here, as indicated by the symbols on the vessel, the 600 carbon atoms built up into olefiant gas, to form, with 1200 hydrogen atoms, 300 molecules of olefiant gas (C_2H_4), which gives 600 volumes; but in this case there would be 1200 atoms of hydrogen set free, which would form 600 molecules of HH, and would equal 1200 volumes, which, added to the 600 volumes of olefiant gas, would give a total of 1800 cubic inches from the elements contained in 1200 cubic inches of CH_4, as might be expected of this gas, consisting as it does of two-thirds hydrogen and one-third olefiant gas. This gas, as you observe, gives when consumed a luminous flame, but the illuminating power would be infinitely small compared with that which would be indicated by the bromine test, for the whole of the olefiant gas, amounting to upwards of 33 per cent., would be condensed, being something like 10 per cent. more than given by gas resulting from the famous Boghead mineral.

A fourth form in which the carbon could be present in coal gas united with hydrogen would be in the form of the vapour of benzol (C_6H_6). The elements contained in 1200 cubic inches of marsh gas (CH_4), when built up into this compound hydrocarbon and from hydrogen would occupy the volume of this vessel, which, as will be evident to you, is still larger than that containing the olefiant gas.

The 600 atoms of carbon would in this case unite with 600 atoms of hydrogen to form 100 molecules of benzol (C_6H_6), which in the gaseous form would occupy 200 volumes; but here there would be 1800 atoms of hydrogen set free, which would form 900 molecules of hydrogen, giving 1800 volumes, and by adding this 1800 cubic inches of hydrogen to the 200 cubic inches of benzol we have a combined volume of 2000 cubic inches as that which the 600 carbon and 2400 hydrogen atoms present in 1200 volumes of marsh gas (CH_4) would occupy when grouped up with benzol and free hydrogen.

The relative proportion of this gas would be 90 per cent. hydrogen and 10 per cent. benzol vapours; but at ordinary atmospheric temperatures the tension of benzol vapours is too low to permit of the benzol remaining in diffusion. However, to show you the enormous illuminating power of such a mixture, I will pass a stream of hydrogen through this Woolf's bottle containing benzol, which is carefully regulated to a temperature of about 90° Fahr., that being the temperature at which the tension of the benzol vapours leads to a diffusion of 10 per cent. through the gas. You observe what an intensely smoky flame is produced.

This vessel contains a mixture of 95 per cent. hydrogen, and 5 per cent. benzol vapours, and, therefore, one-half the quantity present in the gas resulting from the building up of the elements present in marsh gas; yet you see that when consumed it is possessed of much illuminating power, in this case far more than would be indicated by the bromine test, which could, of course, only remove benzol vapours, amounting to 5 per cent.

A fifth, and by far the most interesting condition in which carbon and hydrogen may be combined in gas, is that of acetylene (C_2H_2), as the marsh gas (CH_4) can be directly converted into this compound by means of the electric spark. Thus, 600 molecules of marsh gas (CH_4), occupying 1200 volumes, equals 300 molecules of acetylene (C_2H_2), occupying 600 volumes, and 900 molecules of hydrogen (HH) occupying 1800 volumes; or, in other words, the 1200 cubic inches of marsh gas would become 600 cubic inches of acetylene (C_2H_2), and 1800 cubic inches of hydrogen—in all, 2400 cubic inches, or double the volume which it occupied as marsh gas; yet although the volume has been doubled, the number of carbon and hydrogen atoms is identically the same as when in the form of marsh gas. The illuminating power of the gas, as you will observe, when consumed, may be reckoned at thousands of times greater.

There is yet another form in which carbon is present in coal gas—viz., carbonic oxide (CO). This gas contains 50 per cent. of its volume of carbon vapours, and is present in coal gas in many cases in a larger percentage volume than the illuminating hydrocarbons; yet although this gas contains so large a percentage of carbon in its constitution, you observe that when consumed its flame has no luminosity, and, therefore, this gas does not directly contribute any of the illuminating power derived from coal gas. But it does so, however, indirectly, so to speak, by heating to incandescence the carbon or denser hydrocarbons produced from the decomposition of the hydrocarbons present in the gas. You see that when I pass a current of this carbonic oxide (CO) through this benzol (C_6H_6), it takes up sufficient of its vapour to become a fairly luminous gas. In the same way, this carbonic oxide (CO) may be mingled in volumes similar to the hydrogen present in our previous experiments, with the paraffin (C_6H_{14}), olefiant gas (C_2H_4), and acetylene (C_2H_2) to form a luminous gas. But although the mixture of carbonic oxide (CO) and hydrocarbons contains a much larger percentage of carbon vapours, and although the condensation by bromine would be the same, yet the illuminating power would be considerably less than in the mixture of hydrogen and hydrocarbons. The durability, or the flow of the gases through a given-sized orifice would also be very different, from the fact that the gases would have very different specific gravities.

To begin with, gentlemen, we presented to you this vessel containing 1200 cubic inches of marsh gas, giving little or no light, and we have shown you four other forms of combination of which the elements present in this marsh gas may partake, each gradually increasing in volume till we end with this mixture of acetylene and hydrogen, which occupies just double the volume of the original marsh gas, and yet gives thousands of times the light. On the other hand, we have shown you carbonic oxide containing 50 per cent. of its volume of carbon vapour, giving no light, and when mixed with similar proportions of hydrocarbons to those in the mixture derived from the elements present in marsh gas, substituting the carbonic oxide for the hydrogen, that while the volume of carbon vapour is much larger, the illuminating power is not increased but diminished.

Further, we have shown you that a gas may have a very considerable illuminating power, and yet show no condensation by bromine; and again, on the other hand, we have shown that the condensation by bromine might very much overstate the value of a gas, and be far greater than the illuminating power would indicate.

After such evidence, surely no one will continue to assert that the carbon present in a coal gas, irrespective of the form of combination, bears a fixed relation to the illuminating power; but must rather come to the conclusion that the state in which the carbon is combined with the hydrogen determines the amount of light obtainable from each atom of carbon present in a gas.

This brings me now to the durability in relation to the percentage of carbon in a gas, and to its illuminating power. The writer, and I believe most of those who joined in the discussion at our last meeting, confounded the durability of a gas, as indicated by its consumption with a given-sized flame, with the durability of the same gas when consumed through a given-sized burner under a given pressure. Now, a little thought will convince any one of the absurdity of this course, because, as you know, the durability or rate of effusion of a gas through an orifice under a given pressure depends solely upon its specific gravity; whereas the durability of a given length of flame is altogether independent of specific gravity, but depends upon the characteristics connected with the constitution of the gas, which I am satisfied are closely relative to, although not identical with, those conferring the illuminating power.

For instance, the marsh gas contained in this vessel has a specific gravity of 0·557. The same elements which go to form the marsh gas in this vessel, when re-arranged to form benzol, acetylene, and free hydrogen, occupy larger volumes, and have respectively a specific gravity of 0·334 and 0·279. The marsh gas, therefore, would have a durability, when tested by a burner under a given pressure, much higher than that of the other two, due to their different specific gravities; but when the same gases were tested by a given length of flame, the durability would be reversed, and the lighter gases would have by far the greatest durability. On the other hand, the gases composed of carbonic oxide and hydrocarbon vapour would, from their high specific gravity, have a very high durability when tested by a given-sized orifice under a given pressure, but a comparatively low durability when tested by a given length of flame.

At our St. Andrew's meeting I questioned the soundness of the contention that durability was a factor in the value of a gas to the consumer, seeing that a given volume of gas of a fixed illuminating power gave the same gross amount of light whether it had a high or a low durability, all the difference being that if consumed in a shorter period of time it gave for that shorter period a greater illuminating power; or, in other words, the gross illuminating power was spread over a shorter period of time; and if, on the other hand, it had a greater durability, and the consumption was spread over a longer period of time, then there was proportionately less light per unit of time.

However, the results which I have had the pleasure of laying before you to-day point clearly to the fact that the durability by a given-sized flame is no criterion of the value of a gas to the consumer—from the point of view taken at our St. Andrew's meeting; for the gas which gives the greatest durability by a given length of flame may with a given size of burner have a much shorter durability than another gas having a low durability by a given size or length of flame.

In these few remarks I have endeavoured to show you that the carbon present in coal gas does not determine either its illuminating power or condensation by bromine; and that, although there is found in practice a close approximation between the carbon present in a gas, its illuminating power, durability by a given-sized flame, and the matters condensable by bromine, yet that that is more the result of accident than a feature essential to the constitution of coal gas; that by modifying the manufacturing plant and differently treating the coal during carbonization, and the resulting crude gases during condensation and purification, the elements constituting coal gas might be differently arranged, and produce very different results, thereby altering the relation of the constituents referred to.

The question which naturally suggests itself to our minds is—Why should carbon in one form of combination yield a greater or different amount of light than in another?

Very little consideration serves to show why carbon, when combined with oxygen as carbonic oxide (CO), has not the same illuminating power as the same carbon when combined with hydrogen, because we know that oxygen is a supporter of combustion, and not a combustible in the ordinary sense; and therefore the one atom of carbon in combining with the one atom of oxygen into carbonic oxide (CO), is half consumed into carbonic acid (CO_2), which, as you are aware, is the product of the complete combustion of carbon in oxygen; and as the CO by simple heat cannot be decomposed into its elements, carbon and oxygen, nor yet, when away from contact with other gases, can be decomposed into other forms of combination, neither dense carbon vapours nor solid carbon can be present in the flame of carbonic oxide to convert the long heat-waves into light-rays, or, in other words, give luminosity to the gas. But when the carbon is combined with hydrogen, the matter is not so self-evident, because both the carbon and the hydrogen are combustibles in the ordinary sense of the term. Yet a little closer investigation shows that the causes are very analogous, for carbon combined in the form of a hydrocarbon may be looked upon as a product of the combustion of carbon in an atmosphere of hydrogen gas. In the combustion of carbon in oxygen gas we have only two states of combination, CO and CO_2. When carbon is burned in hydrogen, however, the forms of combination are almost innumerable, but the complete combustion of carbon in hydrogen corresponding to the CO_2 may be regarded as CH_4, or marsh gas,—that being the product of the combustion of carbon when intensely heated, as in the electric arc, in an atmosphere of hydrogen. But just as we can convert CO_2 into CO by what we may be allowed to style "unburning" it—namely, by passing it through highly heated carbon—so in a similar manner we can unburn the carbon when combined with hydrogen in the form of marsh gas; for no

sooner is the carbon consumed under the electric arc, in an atmosphere of hydrogen, into marsh gas (CH_4), than it is partially unburned into other forms of combination, among which are acetylene, benzol, &c. Thus, 2 molecules of marsh gas—$2\ CH_4 + C_3 = 2\ C_2H_2$, or $2\ CH_4 = C_2H_2 + H_6$, and $3\ C_2H_2 = C_6H_6$, and so forth.

Now, in burning carbon into carbonic oxide (CO) and carbonic acid (CO_2), we know that there is a large amount of heat liberated. Careful estimation has shown that the carbon, in burning into CO, gives 2473 units of heat, and that in combining with the second atom of oxygen to form CO_2, it gives 5607 units of heat. You observe that in combining with the second atom of oxygen, a much greater amount of heat is developed than with the first. Now, the reason for this difference is that the carbon, being in the solid state, has to be vaporized before it can be combined with the oxygen, and the difference in the amount of heat from the combination of the first and second atoms of oxygen is expended in vaporizing the carbon. Now, in the unburning of the carbon in carbonic acid (CO_2) into carbonic oxide (CO), exactly the same amount of heat must be expended as was previously generated during the combustion of the carbonic oxide (CO) into carbonic acid (CO_2).

In a similar manner, carbon, when burned in hydrogen, gives out heat when consumed, but the heat developed by the combination of carbon in hydrogen is infinitely small compared with the combustion of carbon in oxygen. This low heat of combustion of carbon in hydrogen is not even sufficient, in the lower form of combination, to vaporize the carbon with which it combines, and, therefore, external heat must be supplied to bring about the union. In the higher forms of combination, as in marsh gas, however, the heat generated is not only sufficient to vaporize the carbon, but there is heat given out during combustion.

MM. Favre and Silbermann found the heat of the combustion of carbon into marsh gas (CH_4) to be + 20,420 heat units. When combined as olefiant gas (C_2H_4) there was no *plus* or sensible heat, but a *minus* heat of 10,880, and when combined into acetylene (C_2H_2) there was a *minus* heat of 55,010 heat units.

We are now in a position to reason out why carbon gives such discordant results, for carbon when in the form of marsh gas (CH_4) is in a partly consumed or burned state, as shown by MM. Favre and Silbermann, to the amount of 20,420 heat units, and consequently when consumed in oxygen or in the atmosphere it has that amount of energy less to develop into heat and light. Further, CH_4, being one of the simplest and most stable hydrocarbon compounds, it does not readily decompose into other denser hydrocarbons, or into its elements, carbon and hydrogen; but the whole burns in the vaporous or gaseous state, and therefore does not give light.

Carbon, on the other hand, when combined with hydrogen in the form of olefiant gas (C_2H_4) and acetylene (C_2H_2), has by its former union conferred upon it a higher potential energy or amount of locked-up heat over the carbon of marsh gas respectively of 31,300 and 75,430 heat units. This extra amount of energy will therefore be developed as light and heat when the gases are consumed. Further, also, those hydrocarbons are not so stable compounds as the marsh gas, and are therefore easily decomposed by heat into very dense hydrocarbons or solid carbon. The surplus hydrogen set free in the decomposition of marsh gas into C_2H_4 and C_2H_2 would, from its very high temperature of combustion, further tend to their decomposition into carbon, and would intensely heat the separated carbon, and further contribute to the amount of light from the carbon atoms.

I fully intended to have tested those various mixtures of gas, with the view of ascertaining their respective durabilities and illuminating powers, and I regret that I have been unable to find time to overtake that task. Perhaps some of the other members of this Association, with more time at their disposal, will, between this and next meeting, make the necessary tests, and give us the results. I am sure that once they commenced they would find much pleasure in the investigation, and the results would be valuable.

But, although we have not obtained the results of careful tests, giving the exact amount of light and durability, by a given-sized flame, we have yet seen sufficient, I hope, to satisfy all present that carbon in different forms of combination gives very different amounts of light when consumed, and to indicate the desirability of a higher technical education in those engaged in the manufacture of gas. Experience, no doubt, is one of the best of teachers, but experience without the aid of technical knowledge is, at best, merely an imitation of previous work. And it is obvious that there must be a limit to imitation, for the conditions which make a system of manufacturing gas successful in one district of a country, from its locality, or, it may be, the nature of the coal or other material to be dealt with, might render it not so successful in another, and call for an altered system of manufacture which would, in great measure, change the nature of the constituents of a gas, and consequently all the relations which experience has shown to exist between illuminating gas and the other conditions referred to in this paper. It is in such cases that a good technical knowledge of the matters with which he has to deal is valuable in assisting a manager out of his difficulties, and enabling him to make progress. With no knowledge that carbon, when in different forms of combination in his gas, gives different amounts of light, but believing that, in all cases, the carbon present in his gas gives when consumed the same amount of light, and with no technical knowledge of how heat acts upon his coal or other substance during destructive distillation, he could not adopt the means necessary for preventing the union of the carbon present in the coal with oxygen to form carbonic oxide, and with hydrogen to form marsh gas—two forms in which the volatile carbon may be said to be wasted; and still less could he adopt the means to bring about the union of the carbon with the hydrogen in such forms as he desires; so that the gas manager, working in the light which guided his predecessors, and as ignorant as they of the principles which are involved in his manufacture, becomes merely an imitative animal, and must necessarily fall behind in the race when matched with the manager possessing a high technical education.

Discussion.

Mr. A. Macpherson (Kirkcaldy): It is with great pleasure that I, with others, have listened to Mr. Young's able paper, and I have to thank him for the kind manner in which he has referred to my previous communications to the Association. I am very glad to think that he and I have arrived at very nearly the same conclusion, but still there is a slight difference. I am not yet quite prepared to admit all that Mr. Young has stated to-day. In my paper last year, while I contended that the durability and illuminating power of gas were dependent on the amount of carbon present, I also contended that it depended on the form in which the carbon was present, so that what Mr. Young has been showing to-day is quite in accordance with what I then advocated—namely, that it greatly depended on the manner and form in which the carbon was present in the gas, for we might have carbon present as carbonic acid, and we know that this, instead of being an advantage to the luminosity, does great damage. I have no doubt, if Mr. Young takes a fair sample of all the gas made in Scotland, he will find that there is a relation between durability and luminosity. We do not expect to find some of these combinations Mr. Young has presented to-day; these are fancy combinations prepared to prove Mr. Young's points. But everybody knows chemistry can be made to prove anything. You will hear one chemist declare one thing, and another the opposite. But let us take what we have to do with—what we are selling every day—fair samples of the gas made throughout Scotland, and I maintain you will find that durability has a very close relation to luminosity. However, I think the point Mr. Young has been contending for to-day and the point I have always contended for are one and the same thing—that it depends on the form as well as the amount. Last year, on the point of durability, I did not contend against Mr. Young's theory. I acknowledged he was right. The case I advanced was a supposititious one, and you will find that I immediately added that it was for the sake of illustration, and not as a matter of fact. I followed up this by saying, "But this could not be." I think, therefore, that Mr. Young and myself have come very near to the same conclusion.

Mr. Peebles: I had the pleasure of taking part in the discussion at at St. Andrew's, and I must say I have come round pretty much to Mr. Young's views. From the way in which the problem was put before us, I did not exactly understand it; but, on thinking over it afterwards, I saw that what was in contention between Mr. Young and Mr. Macpherson was this, that gas with a higher durability with the same illuminating power was the best gas for the consumer. But here comes the question—How can you separate the durability of a gas from its illuminating power?

Mr. Macpherson: That was the position you took up, but not mine.

Mr. Peebles: I will explain my meaning, and how I got misty. Take a gas of, say, 28-candle power as the best with which you can make the experiment, and you consume 5 cubic feet per hour. Now, that is your durability; and how can you, by any method, separate that durability from the illuminating power? That is the point I have come to see clearly, and how I made the mistake. I illustrated the subject by taking two candles that I had bought for a penny, giving the same amount of light while burning, and the one burned longer than the other, therefore the one that burned longest was the better candle for me. But taking 5 cubic feet as the durability of the gases that are tested, and the illuminating power as the basis of that durability, I cannot see how you can separate the durability from the illuminating power.

Mr. J. M'Gilchrist (Dumbarton): This discussion has commenced well, and bids well. We had a sharp discussion on the same point at St. Andrew's, and it is scarcely fair for Mr. Macpherson, after leading so many into his argument, to forsake his followers.

Mr. Macpherson: I rise to order. I distinctly deny the charge.

Mr. M'Gilchrist: I may state that, so far from Mr. Macpherson actually not bringing forward this discussion about durability and illuminating power, it is within a month that he and I had some conversation on the same subject, and then he said he was practically correct in what he brought forward. Mr. Young was theoretically correct, and Mr. Macpherson was practically correct. I said that if Mr. Young was scientifically correct, that was all he contended for—indeed, that was what he said at the meeting. The point at St. Andrew's was that if Mr. Macpherson had a gas of 28-candle power, giving something like 58 minutes of durability, and another gas of the same candle power, but with a durability of only 54 minutes, the gas with 58 minutes durability was a much better gas for the consumer, and a more profitable gas than the gas with 54 minutes durability. What Mr. Young contended for at that time was that the 54 minutes durability gas was quite as valuable and profitable for the consumer as the 58 minutes gas, for this reason, that the 5 cubic feet of gas delivered in the 54 minutes would give a proportionately higher illuminating power per unit of time. The 58 minutes durability with the same illuminating power would be extended four minutes longer, at the expense of the luminosity per unit of time. That is Mr. Young's contention still. You may bring the durability down to 48 minutes, and still have the same illuminating power, owing to the manner in which the gas is built up.

Mr. Macpherson: I think Mr. M'Gilchrist has misunderstood what I said last year, and this will be apparent by glancing at last year's proceedings. The case which was brought forward was a mere supposititious one, and I think you will find I said that Mr. Young was right.

Mr. Young: I do not see the necessity for the display of any personal feeling. We ought to take a broad view of subjects. I was pleased that Mr. Macpherson introduced this matter, and I merely wanted to indicate that we were indebted to him. We have not so many papers in which such a broad view of the subject is taken, and it was because of its breadth that I took so deep an interest in the discussion. I hope, therefore, that personalities will be kept out of view.

Mr. Macpherson: I am merely refuting a charge brought against me of deserting my former followers, as Mr. M'Gilchrist is pleased to call them. I have used no personalities.

Mr. M'Gilchrist: Those who know Mr. Macpherson and myself know that there is no feeling on either side.

Mr. Mitchell (Dundee): I think Mr. M'Gilchrist has brought out in a very clear light the somewhat hazy matter which was before the meeting at St. Andrew's, and has clearly shown this point about durability. It resolves itself into this: Supposing it be the fact that 30-candle gas gives a durability of 68 minutes, Mr. M'Gilchrist has clearly shown that the consumer would simply be getting that amount of light in his 68 minutes which he would get from the same quality of gas consumed in 70 minutes, and it just brings out what Mr. Macpherson wished to show at St. Andrew's—namely, the opinion he held, that it would be more advantageous for the consumer if the gas would last for 70 minutes instead of 68 minutes. It is clear to every one that the problem resolves itself into this, that the consumer would be satisfied with less light per minute from that gas, than he would get from the gas lasting only 68 minutes, and with which, at the same time, he might feel thoroughly satisfied. Therefore, practically speaking, he would burn less gas during the quarter if he elected to burn with the 70 instead of the 68 minutes durability; but that would be simply because he would be satisfied with less light.

Dr. Stevenson Macadam: It is difficult for any one to try and sit upon two stools at the same time, and still more difficult to sit between half a dozen stools. Therefore, I do not intend to make reference specially to the particular points which have been alluded to by the combatants. There is no doubt that the paper brought before us by Mr. Young is a valuable contribution to this branch of the subject. I am not clear that I agree with him on all the points. I have to differ from him that it is an accident—a chance—that there is any connection between the durability of a gas and its illuminating power, or that it is mere chance that there is any connection between the proportion of hydrocarbons in a gas absorbable by bromine and its illuminating power. I think he goes a little too far there. There is no doubt that you may take certain mixtures as he has done, very fairly in illustration of his paper, and show that, so far as these are concerned, there may be no connection between the durability or absorption by bromine and the illuminating power of the gas, but we must bear in mind that in a question of coal gas, we are dealing with a mechanical mixture of gases, and that the mixture may be uniform in regard to the individual gases present, though it may differ in respect of the several proportions of these gases. Whilst I have always maintained, in this room and elsewhere, that we are not bound to trust to the durability of the gas as a test of its possible illuminating power, and that the absorption by bromine is equally not a very

efficient test as a test to be relied upon ultimately in determining the illuminating power, still I think the durability of gas and the absorption by bromine may be taken as fair guides in the way of determining, with greater accuracy than the candle, the illuminating power of gas. I was very glad to hear a remark at the close of the discussion, and which cleared up a point which I must say I was somewhat hazy upon, as well as Mr. Peebles—namely, that if you consume 5 cubic feet of gas and get, say, 30-candle power, and then consume 5 cubic feet of another gas and get 30-candle power, I do not see very well the advantage the consumer obtains with the one gas at a durability, say, of 70, and the other, say, of 68 minutes, except upon this ground, which has been already explained—that a man might be content with a less amount of light. The 30-candle power, with a durability of 70 minutes, is quite sufficient for his purpose, so that the gas would be spread over a greater length of time. I am anxious to keep clear of the previous discussion, at which I was not present; but I think it has gone on at this time with as little personality as could be desired.

Mr. Young, in reply, said: It is very gratifying indeed to have such a discussion following the reading of a paper, and more than usually so to have it closed by such an able gentleman as Dr. Stevenson Macadam. Each speaker has, to a large extent, debated the subject with, and answered his neighbour, and it is therefore scarcely necessary for me to say anything. There are a few remarks, however, made by Dr. Macadam, in which, although we apparently differ in opinion, yet a little explanation will show that even on those points he and I are at one. At the very outset of my paper I prefaced my remarks by the admission that by the present mode of manufacture there was an approximate relation between the condensation by bromine, durability of a given-sized flame, and the illuminating power as ascertained by the photometer, and therefore so far as that mode of manufacture and our present mode of testing were concerned, there was a relation; and my object in bringing this matter before you was to show that those relations were mere matters of accident, and not essential features of the elements of a gas; but that they were dependent upon the mode of building up or grouping the elements to form various compounds, and that therefore if a change in the mode of manufacture were adopted, the elements would be differently grouped, and give very different results. For instance, if the plan proposed some time ago by a London engineer were adopted, of distilling the coal at a very low temperature, first for the production of gas and oil or tar, and afterwards distilling the tars or oils for the production of a further quantity of gas, it is evident that as paraffins are the principal products of the destructive distillation of coal at low temperatures, such a gas, although having a high illuminating power, might give a very low condensation by bromine, since paraffins are not removable by that substance; whereas, if the same coal were distilled at very high temperatures, the paraffins and olefiants would be present in comparatively small quantities in the gas, but would be replaced by the benzol and acetylene groups, and therefore the relation between the various modes of testing would be altered. I know some members of this Association who adopt slightly modified arrangements in their gas manufacture and condensation, using materials different from those usually employed, and who have observed this deviation from the relation between the durability by a given-sized flame, the condensation by bromine, and the illuminating power. Then, in reference to the durability being a criterion of the value of a gas to the consumer, I very much fear that the drift of what I wished to convey has been missed. The consumer does not measure the size of his flame. What he does is to turn on his gas and light it. Therefore, the quantity of gas which passes through his burner under a given pressure depends solely upon its specific gravity, as that is the only physical matter affecting the flow of gas through a given-sized orifice under a given pressure. If the specific gravity of a gas and its durability by a given-sized flame invariably followed the same ratio, then the durability by a given-sized flame would bear a fixed relation to the durability of the gas to the consumer; but that such is not always the case I need not say. A slight increase in the quantity of carbonic oxide would increase the specific gravity and increase also its durability by its passage through a given-sized burner, but would decrease its durability by a given length of flame; and those mixtures of gases before us show in a still more exaggerated form how a durability by a given length of flame bears no relation to the durability of the flow of the gas through a given-sized burner. The marsh gas in this vessel has a specific gravity just double that of the mixture of acetylene and hydrogen in that other vessel. The marsh gas, therefore, from its high specific gravity, would flow much more slowly through a given-sized burner than the lighter composition of acetylene and hydrogen; but if the mode of testing were by a given-sized flame, the durabilities would be reversed, for as the marsh gas has little luminosity, the carbon burning in the gaseous state, a much larger quantity would require to be passed to bring up a given-sized flame than with the acetylene compound, because the carbon is then liberated in large quantities and passes through the successive stages of combustion, giving great luminosity, and consequently a comparatively small quantity would be required to make up a given-sized flame. It is indeed a difficult matter to get a clear conception of durability, and to separate the durabilities from one another; but consideration of the matter will do it; and I am certain that if, between this and our next meeting, members will only take the necessary trouble of examining various mixtures of gases such as these which I have shown you to-day—and I would myself be glad to join in any such experiments—they would find the investigation interesting, and would elicit valuable information. I believe that the more technical knowledge we possess of the behaviour of the materials with which we have to deal, the more rapidly shall we advance in our profession.

The President: I have no doubt we shall have some valuable papers on this subject at our next meeting; but in the meanwhile we ought to accord a hearty vote of thanks to Mr. Young.

(To be continued.)

Taunton Gas Company.—From the report presented to the thirty-fourth annual meeting of this Company last Tuesday, it appears that the quantity of gas sent out during the twelve months ending June 30, was 41,778,600 cubic feet. The Directors recommended a dividend of 7 per cent., and announced that they had resolved to allow a discount of 3d. per 1000 cubic feet to all private consumers of gas whose consumption should amount to 10,000 cubic feet per quarter, to commence with the accounts accruing due on the 15th day of September next, provided that payment be made within one month after delivery. The accounts show that for the past year £629 17s. 2d. was received from the Town Council for gas supplied to the public lamps; £7766 8s. from private consumers; and £1764 2s. 11d. from coke, tar, meters, stamps, &c. Coal, including carriage, cost £3061 3s. 11d.; manufacturing wages, labour in yard, &c., £935 18s. 3d.; repairs and renewals at works, £776 19s. 4d.; repairs and renewals of meters, mains, and services, £454 2s. 1d.; rates and taxes, £294 10s. 4d.; salaries, £262 10s.; besides other miscellaneous charges. The capital of the Company consists of £30,800 in shares, and there is a mortgage debt of £8666. The total amount expended on capital account is £41,103 11s.

THE ELECTRIC ARC: ITS RESISTANCE AND ILLUMINATING POWER.

By Profs. Elihu Thomson and Edwin J. Houston.

[From the *Journal of the Franklin Institute*, Philadelphia, U.S.A., July, 1879.]

From a series of investigations made by us in the winter of 1877–78, and published in the *Journal of the Franklin Institute* for May and June, 1878, as part of a report of the Committee of the Franklin Institute on dynamo-electric machines, we were led to infer the existence in the electric arc of certain relations between resistance, current strength, and illuminating power. Further experiments in the same direction have seemed to confirm these relations. We, therefore, have taken the opportunity of stating them, believing that they will be of value to other investigators in this field.

The relations existing between arc resistance and current strength, and between current strength and illuminating power, are apparently expressed by the following laws, viz.:—

1. In arcs of equal lengths the resistances are inversely proportional to the current strengths.
2. The illuminating power of an arc is approximately proportional to the current traversing it.
3. In arcs of equal length the total energy given out is proportional to the current strength.

Whether the above laws will be established for great range of conditions remains for future investigation; and, indeed, when it is considered that it is almost impossible to maintain arcs of equal lengths, the results may be regarded as approximately true, and point to the need of an extended series of experiments, in order that the errors in individual cases may be eliminated. The experiments we are now conducting in this direction are not yet complete, and embrace, besides the laws just stated, other interesting relations. We have thought, however, that the results thus far obtained justify the publication of the above statements of existing relations.

The following theoretical considerations, aside from experimental data, serve partly to explain the first law. An increase of current is attended by a more active transference of carbon vapour from the positive to the negative electrode, which would result in an increased breadth of arc, and, consequently, decreased resistance.

The bearing of this law on the question of the economical division of the electric current in the production of several arcs in the same circuit, instead of one single arc, is important. It has been held by some that if the intensity of the current be halved, the work being as the square of the current, economic division is impossible. It must not, however, be forgotten, as appears to have frequently been the case, that the above statement assumes that the resistance is constant. With the arc, however, the resistance with a changed current is not constant. If the current be doubled, its resistance is halved; if the current be halved, its resistance is doubled—always assuming the distance between the electrodes to remain constant. The work of the current, therefore, with a given length of arc, is proportional to the current, and not to the square of the current, as has been frequently assumed. The third law expresses this relation, the total energy being the work given out as light and heat, and due to the current traversing the resistance, which resistance falls as the current increases, and the converse.

The total energy evolved in an arc does not, however, appear to be a measure of the illuminating power of the arc, it having been noticed by us that the total energy in the arc may be the same, while the illuminating power varies considerably. The illuminating power of arcs representing equal amounts of energy evolved, appears to be affected considerably by the distance apart of the carbon electrodes. It is found in practice that, in any case, the maximum illuminating power is obtained when the electrodes are separated to a certain distance. An increase of this distance between the electrodes is attended by an increase of the resistance of the arc, and by a decrease in the current strength, not, however, proportional to the increased resistance. Consequently, an increase in the total energy evolved in the arc may take place while an actual decrease of the illuminating power has resulted. This last statement may at first appear to involve a contradiction, but when it is remembered that the greater portion of the light evolved by an arc comes from the intensely heated surfaces of the electrodes, and not from the heated gas stream constituting the arc proper, it can readily be understood that with a large arc a considerable proportion of the energy will be expended in sustaining the temperature of the gas stream, and supplying or making good the heat convected from it to the surrounding air. In an arc of less length, a smaller proportion of the energy is expended in sustaining the temperature of the gas stream, and the amount of surface of the electrodes heated to intense incandescence is relatively increased.

It is our opinion that the relation between the illuminating power and the current, as expressed by the second law, is necessarily quite approximate, since the distance apart and consequent facility for loss of heat by convection from the electrodes cannot be without influence on the illuminating power.

Central High School, Philadelphia, June 13, 1879.

City of Norwich Water-Works Company.—The half-yearly meeting of this Company was held last Wednesday—Mr. H. S. Patteson in the chair. The Secretary read the statement of the receipts and expenditure of the capital and revenue of the Company up to the 25th of March, 1879, which were laid on the table for the inspection of the Shareholders, and afterwards the report of the Directors, which stated that after payment of working expenses, debenture interest, and preferential dividend, the revenue account showed a balance sufficient to pay a dividend at the rate of 6 per cent. per annum, deducting income-tax, on the ordinary share capital of the Company, leaving a balance of £1042 3s. 10d. The report proceeded:—"It has hitherto been the custom of this Company to collect the water-rates after the expiration of the quarter in which the water has been supplied, notwithstanding the Water-Works Clauses Act, 1847 (incorporated with the Acts of this Company), which enacts that all water-rates for domestic supplies of water shall be paid in advance. It has been decided, however, by the Judges of the Common Pleas Division of the High Court of Justice, in a case in which the Sheffield Water-Works Company (who had also collected their rates at the expiration of each quarter) were parties, that in order to preserve to the Company their statutory remedy for the recovery of water-rates, and to comply with the provisions of the Act of Parliament relating to them, the rates for water not supplied by measure must be collected in advance in the manner prescribed by the Act. This decision has rendered it necessary for your Directors, in order to maintain their legal position, and protect the Company, to give notice to their customers that the water-rates for domestic supply would be collected in advance, as and from the 24th of June last. The construction of the new works at Heigham pumping-station was proceeding, and it was hoped would be completed during the next year. By the death of Henry Woodcock, Esq., a vacancy was occasioned on the Board, and Samuel Gurney Buxton, Esq., has been appointed a Director in his room." The Chairman moved the adoption of the report, which was seconded by Mr. Bacon and carried. Formal votes of thanks to the Directors and Manager (Mr. J. Ayris) brought to the meeting to a close.

THE LANCASHIRE COAL AND IRON TRADES.

(FROM OUR OWN CORRESPONDENT.)

The coal trade throughout this district continues extremely dull, and the rumours of a further reduction of prices in the Manchester market, to which I referred in my last report, have been fully verified, the leading firms having this month made reductions in their list rates for delivery into the Manchester district, ranging from 3d. to 5d. per ton upon furnace coal, burgy, and slack, and 5d. to 10d. per ton upon house-fire classes of fuel, whilst pit prices have been reduced from 3d. to 5d. per ton all round. In other Lancashire districts prices also tend downwards, for, although no formal reductions are being made in the list rates, there is a gradual giving way on the part of sellers wherever they have to force sales to get rid of stocks, and prices are so irregular that it is difficult to give any fixed quotations. For the better classes of round coal the demand is exceptionally dull, even for the season of the year, and for gas-making coals there are but few contracts which are now open, whilst the lower classes of round coals for iron-making and steam purposes are in very limited request. The present very small production of slack is causing this class of fuel to be less plentiful in the market, but the diminished supplies are quite counterbalanced by the exceptionally small requirements of consumers, owing to so many of the mills being either partially stopped or put on short time, and the general depression throughout the chemical, salt, and brick-making trades. Quoted prices at present are not of much value, as, where anything like sales in bulk are concerned, they are so frequently a matter of arrangement between buyers and sellers; but the better classes of house coal are being sold at about 7s. 6d. per ton at the pit mouth, second qualities for either house-fire or gas-making at from 6s. 3d. to 6s. 9d.; common round coal at 4s. 9d. to 5s. 3d.; burgy at 3s. 9d. to 4s. 6d.; good slack at 2s. 9d. to 3s. 3d.; and common sorts as low as 2s. per ton.

In the shipping trade a moderate amount of business is being done, but at very low prices.

Throughout Lancashire the output of coal is generally being restricted, and the pits, as a rule, are being put on short time.

The iron trade of this district continues in an extremely depressed condition, and, with but few exceptions, works are only just kept going from hand to mouth on short time. Pig iron is very bad to sell, and at present there are no list prices, makers being open to offers where buyers have orders to give out; but nominally Lancashire No. 3 foundry is quoted at 44s., and No. 4 forge at 43s. 6d. per ton, less 2½ per cent., delivered into the Manchester district. Finished iron also meets with a very poor demand, and orders are so keenly competed for that prices are now down to a point which can leave no possible margin for profit, common bars delivered into the Manchester district being obtainable at about £5 per ton.

THE COAL AND GENERAL TRADES OF THE NORTH OF ENGLAND.

(FROM OUR OWN CORRESPONDENT.)

The shipments of gas coals were more active last week. Messrs. Joicey's and the best gas collieries were fully employed. The price of best gas coals, especially for single cargoes, was stiffer. There was likewise a much better demand for the medium sorts. The price has been unchanged for the latter. Inferior gas coals occupy a poor position upon the quotations. The orders for small cargoes of gas coals for Ireland and the Channel ports have increased, and a little more business has been done in that direction. There are no reports of large contracts having been settled lately, but upon the contracts recently made there has not been any material alteration in prices. Business in gas coals is likely to be steady over the autumn months. The coke trade is comparatively dull. Steam coals are in pretty active request, being sold at lowish rates. Inferior coals of all descriptions keep in the market, and this tends to cheapen most other kinds of coals.

The shipping trade of the week shows a slight advance upon coasting rates for sailing ships, and a rather stronger demand for steamers. With this exception, however, that the business to London is very dull, and the few sailing ships that are on offer experience considerable difficulty in entering upon engagements. Gas coals have been sent abroad in rather larger quantities, and the shipments from Tyne Dock last week were very considerable.

The Cleveland iron trade has become stronger. There is an improvement in prices, and the tone of business is altogether better. The chemical market is firm, with rates having a slightly upward tendency. There continues to be rather large arrivals of lead. The price is about £13 15s. per ton. Best fire-clay goods continue in steady demand for select qualities. Other sorts are not much looked after, and are rather low in price. There is no change in the labour market. The Durham miners have had to submit to a reduction of 1½ per cent. upon the decision of Earl Derby, the Umpire. This makes the reduction arising out of the great strike 10 per cent. for men working below ground, and 8 per cent. for surface men. The Cleveland ironworkers have also received notice of a reduction.

TRADE NOTES FROM SCOTLAND.

(FROM OUR OWN CORRESPONDENT.)

When speaking of the excitement in connection with gas affairs in Hawick some three weeks ago, and of the annual meeting of the Hawick Gas Company, which had recently been held, I remarked that there would doubtless soon be another phase of affairs as a consequence of the vote passed at the meeting referred to. Contrary to the recommendation of the Directors, it was resolved at the annual meeting of the Shareholders, by a majority of 45 votes to 38, to increase rather than reduce the price of gas by 5d. per 1000 cubic feet. The Directors wanted the price for the ensuing year to be 3s. 9d., but the Shareholders fixed it at 4s. 7d. per 1000 feet. On Friday last a special meeting of the Shareholders was held in the Town Hall, for the purpose of considering that resolution, and of adopting the recommendations of the Directors, if that should seem to be desirable. The Chairman (Mr. Melrose) said that the resolutions at the former meeting respecting the price of gas and election of Directors were contrary to the terms of co-partnery, and that if it was attempted to carry them into effect the Directors could not enforce a single payment during the year, inasmuch as every consumer was at liberty to object to the price of the gas. He believed that at least some of the Shareholders at the former meeting had voted for the resolution that was then carried, in ignorance of its terms. The accumulated profits of the Company amounted to £1968, and, after paying the dividend, there would still be a balance of over £1000, which they were bound to apply to the reduction of the price of gas. After a good deal of discussion upon the subject, the following motion was agreed to:—"The meeting having considered the subject for which they were called together, find that the resolutions of last general meeting as regards the price of gas and the appointment of Directors were inconsistent with the terms of the agreement of 1873, and therefore resolve—(1) That said resolutions be rescinded; (2) that the recommendation of the Directors as to the price of gas for the current year—viz., 3s. 9d. per 1000 cubic feet—be adopted; and (3) that the following gentlemen be elected Directors for the ensuing year, in place of those retiring: R. F. Watson, J. Oliver, and T. Laidlaw."

Since the publication of my last "Trade Notes" the annual meeting of the Lanark Gas Consumers Company, Limited, has been held. The recommendation of the Directors to declare a dividend of 5 per cent., and to reduce the price of gas from 5s. to 4s. 2d. per 1000 cubic feet, was agreed to.

The Burntisland Town Council entered into possession of the local gas-works on Friday, Aug. 1. The former proprietors, the North British Railway Company, are to be supplied with gas for their locomotive and other works at a reduction of 20 per cent. from the ordinary charges.

On the question of the cheapest gas in Scotland, some further remarks have been called forth from the Editor of the *Dundee Advertiser*, *à propos* of the short statement which I made last week in regard to the claims that Perth has lately been setting up. In his issue of last Thursday he quoted that statement, to which he appended the following remarks:—"The above," he said, "is completely vitiated by two serious misstatements. The writer first overlooks altogether the mortgage debt on the Dundee Gas-Works, which, added to the annuities, makes the charge not 8d., but 1s. 1½d. per 1000 feet, as against 1s. 2d. in Perth. Then it is not the case that large sums of money for repairs are added to capital in Dundee. We are assured," the Editor goes on to say, "that every penny for repairs is paid out of revenue. The claim in favour of Perth, therefore, cannot be maintained." In the following day's issue a short editorial appeared by way of correction. It was as follows:—"We yesterday unintentionally overstated the charge for annuities and interest on the gas sold in Dundee as being 1s. 1½d. per 1000 feet, as against 1s. 2d. in Perth. We have been favoured with a statement by the Treasurer of the Dundee Gas Commission, showing the quantities of gas sold in Dundee and Perth last year, and the amounts paid in annuities and interest. The figures are—Gas sold in Dundee, 271,205,400 cubic feet; ditto in Perth, 48,058,250 cubic feet. Annuities in Dundee, £8337 4s. 6d.; interest in Dundee, £4855 0s. 1d.; total, £13,192 4s. 7d. Annuities in Perth, £2812 10s.; interest in Perth, £317 18s. 11d.; total, £3130 8s. 11d. The annuities and interest in Dundee, therefore, amount as nearly as may be to 11½d. per 1000 feet, against 1s. 3½d. in Perth, or a difference of 4d. per 1000 feet. The price of gas, however, in Perth was, after deduction of discount, 5d. higher than in Dundee, or 3s. 8½d., against 4s. 1½d. The first cost was in Dundee 3s. 11d., and in Perth 4s. 2d.; but there is a discount, to all in Dundee who pay their accounts within a month, of 5 per cent., or 2½d. per 1000 feet; while in Perth there is only a discount to certain consumers equal to 1 per cent. over all, or ½d. per 1000 feet. These are the figures for last year. The price in Dundee is now reduced to 3s. 8d., which, after deducting 5 per cent. discount, is practically 3s. 5½d. The price, therefore, in Perth or Galashiels must be reduced below that before it can be alleged that in either of those places the gas is cheaper than in Dundee." Whether it is Perth, Dundee, or Galashiels, Paisley, Greenock, or Glasgow, that produces the cheapest gas, I am not in a position to say with certainty; but I think it is right that I should do my best to encourage the discussion of the subject, believing that good will eventually result to the gas world in Scotland. The JOURNAL OF GAS LIGHTING is the proper medium for the discussion, and therefore, so far as I am able, I shall reproduce a summary of the remarks that may appear from time to time in the provincial journals, so that those persons who are specially interested in the subject may have an opportunity of seeing them. If the esteemed Gas Manager in Perth, or the Chairman of the Gas Committee, or any other person in the "Fair City," feels inclined to add to the interest of the discussion at present in progress, he has now a fair chance.

It is with extreme regret that I notice the death of Provost Murray, of Paisley, on Tuesday last, in his 72nd year. He entered the Municipal Council of his native town as far back as the year 1836, and in 1844 he was elected Chief Magistrate, which honourable appointment he retained till 1850, when he retired from the Council. He again, in 1869, at the request of many of his fellow-townsmen, returned to the Council, and was at once re-elected to the Provostship, which he retained till his death. In addition to his management of municipal affairs generally, for which he had an extraordinary capacity, Provost Murray signalized his career as Chief Magistrate specially in connection with local gas affairs. About the time when he was first elected Provost a new gas company had been started in the town, having a joint directorship of Shareholders, and Members of the Town Council, the intention being that the gas-works would eventually become the property of the Corporation. Thus it was that when Provost Murray returned to the Council in 1869, a feeling existed that the time had arrived when those gas-works should be transferred wholly to the Corporation, in order that the community might reap the benefits of any surplus funds which arose from its management. The Provost was not long in getting this accomplished, and an Act was obtained on July 3, 1870, transferring the management of the gas-works to the Corporation as desired. From year to year Provost Murray, as the head of the Corporation, took a keen interest in the progress of the works, and made himself thoroughly familiar with all the *minutiæ* of the gas supply undertaking, so far as it concerned the ratepayers and the Council as the owners of the works. He never failed to quote statistics, bearing upon the subject, without imparting to them a peculiar attraction. On Saturday afternoon a public funeral took place by way of honouring the memory of the deceased municipal chief, and mourners came from far and near to pay their respect to his high and sterling character.

The Glasgow pig iron warrant market was very depressed, and receded rapidly in the early part of last week, but towards the end a slightly better feeling set in, and prices improved a little. A large business was done daily. At the close on Friday there were buyers at 40s. 7½d. cash and 40s. 10d. one month, and sellers near.

Dulness is still the rule in the local coal trade, and, notwithstanding the fact that the miners are working unsteadily, and asking an advance of wages here and there, prices have not yet advanced.

REDUCTION IN THE PRICE OF GAS AT NEWTON-LE-WILLOWS.—At the last meeting of the Gas Committee of the Newton-le-Willows Improvement Commissioners, it was resolved to recommend the Board to make a reduction in the price of gas equivalent to 3d. per 1000 feet. In the event of the recommendation being adopted, the prices will be as follows:—3s. 6d. per 1000 feet, with 6d. per 1000 feet discount on quarterly bills paid within a month; while to consumers of over 20,000 feet the rate will be 3s. 5d., with a like discount; and to the Railway Company, who pay monthly, 2s. 9d. net.

SULPHATE OF AMMONIA PLANT.—With reference to the illustrations of apparatus for the manufacture of sulphate of ammonia which were published in the JOURNAL of June 10, pp. 882-3, we have since learned that the plan, from a tracing of which our engravings were copied, was prepared by Mr. E. S. Cathels, late of the Crystal Palace District Gas Company, but now of Three Rivers, Quebec, Canada. Had we known the fact at the time, it would certainly have been acknowledged; and we now have pleasure in crediting Mr. Cathels with designing the arrangement.

EXTENSION OF STOREAGE AT THE RAMSGATE GAS-WORKS.—There has recently been completed at the Ramsgate Local Board Gas-Works, from drawings and specifications furnished by the Engineer, Mr. W. A. Valon, a

gasholder, of which the following description was given by the Chairman of the Board (Rev. E. G. Banks), at the "christening," which took place recently:—The excavation for the tank and holder is made entirely in chalk, and, with the exception of the side nearest the old gasholder, no timber was necessary for securing the ground, the chalk being sufficiently firm to keep its place. The tank is constructed entirely of concrete, the materials used being sand, beach, and Portland cement. The bottom of the tank has a covering of 3 feet, the sides being nowhere less than 2 feet in thickness, varying in some places and where necessary to 4 feet. The piers are also of concrete, solid throughout, 6 feet wide by 8 feet deep, and carried up uniformly with the tank. The mound of chalk in the centre is covered by 18 inches of concrete on all sides, the upper part of the tank, where it leaves the ground, being hooped by circular and upright bars of iron, 1 inch in diameter by 6 feet broad. All the interior of the concrete work has been rendered by a mixture of cement and washed sand, the whole being trowelled to a fine surface in a neat cement, which, upon examination, has nowhere, up to the present, broken the continuity of the surface. The tank is 112 feet in diameter, and 28 feet in depth. The holder is constructed entirely of wrought iron, with the exception of the base-plates, guide-rollers, and standards for securing the railing on crown. The weight of the wrought-iron standards, girders, finials, &c., forming the framing, is 170 tons, the holder itself, including roof, side stays, &c., over 200 tons, making the gross weight about 370 tons. The holder is 110 feet in diameter and 26 feet deep, and when filled will contain 500,000 cubic feet of gas. The tank has a capacity of about 1 million gallons of water. The storeage thus secured to the works is equal to the maximum production of 24 hours, and will be sufficient to meet the usual rate of increase for the next eight or nine years. The contract price for the tank was £3000, and for the ironwork £5367; the total cost, allowing for extras, being about £9500. The cost per 1000 cubic feet of storeage is, therefore, about £19.

THE GAS SUPPLY OF NEW YORK.—The *American Gaslight Journal* of the 16th ult., referring to the recent action of the Gas Companies (mentioned in last issue) in reducing their prices, says: "How the stockholders are to be benefited by all this is a problem containing several unknown quantities, and has not yet been solved. If we were to suggest a remedy in a general way for this epidemic, it would be to amalgamate all the Companies into one, with a capital stock not exceeding 5 dols. per 1000 feet sold annually by all put together, and then sell gas at such a price that, while it would secure a fair remuneration for the money invested, would be low enough to prevent the starting of any other competing company. In order to do this, the manufacture must be conducted on the strictest scientific principles, and the sale upon purely business principles. It certainly would be possible, with such an organization, to sell gas at such a price that the consumption would be very largely increased both for domestic and other uses, and competition defied. The harmony and co-operation which has so long existed between the old New York and the Manhattan Companies has been very seriously disturbed by the action of a majority of the Board of the New York Company, in purchasing the right to use the Tessié du Motay process, with the understanding that the Municipal Company do not enter into competition with them in the district below Grand Street. It is understood that this action was taken in spite of the non-concurrence of those members of the New York Company's Board who are most actively interested in the Board of the Manhattan Company. So radical a change as this, if they actually put the process in operation, must have had the guarantee of reasons satisfactory to those who brought it about. What effect the reduction in price which has since taken place may have on calculations based on the old price, could be better determined if it were known exactly why the process was bought. Certainly 900,000 dols., which is the sum said to have been paid by the New York Company to the Municipal Company, will be a very convenient little amount of pin-money for the latter to have at the beginning of the war, as it is so much clear gain to start with. Whether the effect of reducing prices will make it more convenient for the New York Company to pay that amount, and as much more, perhaps, should they erect works for using the process, is not quite so clear. Thus the war begins with "Every fellow for himself;" and it is to be hoped that, after the amusement has been continued long enough to satisfy all concerned, it will be terminated by an amalgamation that shall be honest and permanent, and that afterwards the manufacture and sale of gas in the city of New York will be conducted on a true business basis. If this be the result, the fight will not have taken place in vain. The people will be benefited permanently, and the investor will have a sure, reasonable return for his money. The prime cause of the fight is too many companies, and too much stock and bonds as a consequence. It would appear that a natural result ought to be a reduction of both. There certainly is no money to be made by selling anything without a profit; and if, as stated, gas is being sold at less than it costs to produce it, while the consumer may rejoice, the stockholder must suffer, and would it not be far better to pocket the first loss, and reduce the capital down at once to an amount sufficient for carrying on the business, and put an end to a waste and throwing away of resources? This is a point worthy of consideration by all stockholders. London and Paris have both been through this same contest, and the result has been amalgamation and cheap gas."

Register of Patents.

4530.—BOAG, J. D., Hackney, London, "*Improvements in the manufacture of gas for illuminating and heating purposes.*" Provisional protection only obtained. Dated Nov. 30, 1877.

This invention relates to the manufacture of gas from sewage, fœcal, and decomposed vegetable matters, and consists—first, in the employment of a mixture of colza and paraffin oils, which is introduced, together with the sewage, fœcal, or vegetable matters, into the first retort; secondly, in the method and means adopted for mixing the oils with the sewage or other matters, and introducing them together into the retort.

In carrying out the invention a comparted tank or reservoir is employed for the mixture of oils, and the sewage, fœcal, or vegetable matters mixed with sufficient urine or stagnant water to flow freely. This reservoir is mounted above a funnel-shaped receptacle, whence a pipe leads to the first retort, and the two compartments of the reservoir are each provided with cocks for running off the contents into the funnel. The oils and the sewage, fœcal, or other matters are made to mix in the proportion of about 10 per cent. of the former to 90 per cent. of the latter, by causing the proper proportion of the liquid matters to flow in alternately with a drop of the oil, so that each drop of oil is carried along separately by the flow of the liquid matter to the retort, before reaching which an intimate mixture is effected.

One or more retorts are employed, made of cast or wrought iron, fire-clay, or other material that will stand the heat and pressure. The retort or retorts must be raised to a red heat before the matters are introduced, and must be maintained in that state. The gas so generated can be passed through the remainder of the retorts, thence through an ordinary condenser on to the water purifier, where the pipe should dip. Screwed to the mouth of the dip a perforated cap is used, and, after passing through a lime purifier, the gas is stored in a gasholder.

4536.—WIRTH, F., Frankfort-on-the-Maine, "*Improvements in purifying water.*" A communication. Patent dated Dec. 1, 1877.

This invention relates to improvements in the method of purifying water, and consists in the application of oxide of magnesia, which, like lime, purifies water from the following impurities at an ordinary temperature; the impurities being bicarbonate of magnesia, calcium, iron, silicious and clayey earths, and such like. On mixing with water any of the above, it immediately turns very thick, but the matters soon precipitate, and, after having stood for some time, the water becomes perfectly clear.

The improved method has a great advantage over the lime method, inasmuch as magnesia not being easily decomposed in water, it can be placed in the water reservoir or holder a considerable time before the water is required, the superabundant precipitate enveloping the lime, this precipitation being repeated each time the water reservoir is filled with fresh water, and taking less time as it gets thick, and therefore falling more rapidly.

4538.—BENSON, M., Southampton Buildings, London, "*Improvements in pipe-joints for containing liquids, gases, and air, but more especially applicable to gas and water mains.*" A communication. Provisional protection only obtained. Dated Dec. 1, 1877.

The invention is designed to furnish a means of rapidly and economically forming a fluid-tight joint in pipes, and is especially adapted to gas and water mains. Various devices for effecting this end are in use, consisting essentially in means for driving or caulking a packing material into the pipe-joint or connection, or forcibly drawing the pipe section upon elastic or other gasket material. From its property of resisting the action of corroding agents, lead is almost universally used as a packing, and is most commonly applied to the joint by casting it in place, and subsequently caulking it. The usual caulked joint, however, aside from being uncertain and expensive, is open to the objection that the slightest deflection or sagging of the pipes or mains causes leakage.

By this invention all the advantages of lead packing are secured, and at the same time danger of leakage from sagging or other ordinary change of position in the mains is obviated. These desirable ends are attained by casting a lead gasket within a groove in the interior of the bell or socket of the pipe, and, after the sections are in place, forcing the gasket to its seat by means of fluid pressure.

4552.—GENT, J. S., Manchester, "*Improvements in the manufacture of gas-burners.*" Provisional protection only obtained. Dated Dec. 1, 1877.

This invention has for its object improvements in the manufacture and finishing of gas-burners. The burners are made of cast iron, coated first with copper, and afterwards with silver superposed upon the copper coating, the object being to prevent oxidation in the slot and jet holes or of the body of the burner.

4555.—VOISIN, A., Paris, "*Improvements in the method or process for lighting gas-lamps or burners by electricity, and in apparatus employed therefor.*" Provisional protection only obtained. Dated Dec. 1, 1877.

This invention consists in lighting a gas-burner of any form or shape, and at any distance, by means of a platinum wire or ribbon slightly reddened by means of an electric current.

To produce the current, the patentee employs by preference a battery in which the positive element (flat or curved) is surrounded with a depolarizing body on which rests a suitable porous substance holding an exciting liquid. The negative element is arranged in such a manner that a mechanical movement is necessary to put it in contact with the exciting liquid at the required moment. Any other suitable source of electricity may be employed.

The battery placed as a fixture or arranged in a handle, at the end of which is placed the platinum wire, is put in action at the moment that this wire is thrust into the current of gas, the action of the battery is stopped, and the wire is withdrawn from the action of the flame as soon as the lighting has taken place.

The wire may be brought by the hand over the current of gas, or the burner itself may be brought towards the platinum wire, and cause the passage of the current by its striking against a knob or button or other similar arrangement; or the cock placed under the burner may be provided with wire suitably isolated and put in communication with the current in such a manner that the moment the cock is opened the current passes and lights a small escape of gas produced by the movement of the cock itself, and extinguished by following this same movement as soon as the lighting of the burner is effected.

The escape may be placed at any suitable distance from the orifice, and the communication of its flame with the gas-jet may be facilitated, if necessary, by forming an opening in the wire gauze or other basket interposed.

When the burner is at a great distance from the cock, an auxiliary pipe is employed, bringing the small escape near to the burner and platinum wire, and near the cock is arranged a knob or button or other apparatus, opening at the same time the electric circuit and the entry of the gas in the auxiliary pipe, then closing them both immediately after the burner is lighted.

4558.—CLARK, A. M., Chancery Lane, London, "*Improvements in the manufacture of hydraulic limes and cements.*" A communication. Patent dated Dec. 1, 1877.

This invention relates to improvements in the manufacture of hydraulic limes and cements, and consists in subjecting the raw materials to be converted into hydraulic limes or cements to a special treatment with acids.

The improved method of making hydraulic limes and cements is as follows:—Instead of keeping down the heat of the kiln in which the materials are calcined within certain limits, the patentee so raises it as to over-burn the products. In certain cases he extracts, if necessary, the first lime, which is in excess, and then subjects the nodules and under-burnt remainder to the action of a bath of dilute hydrochloric acid. The proportion of acid will, of course, vary with the amount of lime contained in the under-burnt portion and nodules, but it could not exceed on an average 3 or 4 per cent. The proportion should, in all cases, be determined with accuracy by a preliminary test and a previous analysis of the raw materials. Hydrochloric acid is employed by preference, but the patentee reserves the right of using any other acid which will yield analogous results. The nodules and under-burnt portion are allowed to effervesce in the acid baths until quite cooled, and are then dried in a furnace until fit for grinding in the ordinary manner.

In manufacturing limes and cements, according to this invention, the acid treatment may be applied either before or after burning, and either in the dry or humid way, whether such acid be used in the form of a vapour or gas, in the concentrated form or in solution in water, and whether such acid be made to act separately on the minerals or elements of which the limes and cements are composed, or upon the raw material itself.

By means of this invention hydraulic cements and limes may be over-burnt without injury, the under-burnt portion and nodules (which in the

ordinary process of manufacture are wasted and cause considerable loss) being utilized for the manufacture of hydraulic limes and cements of first quality.

4576.—Hilton, M., Prestwich, "*Improvements in the manufacture of gas.*" Patent dated Dec. 3, 1877.

This invention consists chiefly of improvements in the methods pursued and the appliances used in the distillation of illuminating gas, and for utilizing some of the waste products, and its object is to make the distillation process as nearly as possible automatic and continuous. For this purpose the patentee prefers cast-iron or other metal retorts, and these are carried in the furnace by bearings, and are supported, if desirable, by ordinary mechanical devices, such as friction rollers, the retort being made to revolve by means of a wheel fixed on it in a convenient place, such as the projecting ends, which is driven by a pinion or worm, or in any other convenient way, a number of wheels being employed if desirable. The ends projecting beyond the furnace are turned or prepared in some other suitable way, so that an air-tight joint may be formed by means of packing and glands, or some other known means of making joints. To each end of the retort a stationary casing of cast or sheet iron, or other suitable material, is attached by the air-tight joint above mentioned, one such casing serving the purpose of receiving the coal or other material from which the gas is to be made, the other to discharge the coke. On either or both of these an ascension-pipe, to take away the gas, is fixed, preferably on the discharge-box, so that any tar drippings may fall on the coke.

The feed-box contains a small opening of circular or other shape, to which opening a prolongation of about the same area is attached, in which works a pusher or piston of suitable construction. This feed cylinder is in communication with the coal supply. The coal may be ground as nearly as desired into a powder, and brought by mechanical means, such as a creeper or the like, from the storing place into a hopper fixed close to the retort, or it may be fed directly from an opening in the creeper-box or cylinder to the pusher-box or cylinder by a tubular connection, into which one or more valves may be inserted to open and close alternately the communication, so that both are not open simultaneously, in order to reduce or prevent the loss of gas, or the influx of air, as the case may be.

The piston or pusher, as well as the valves, is actuated by suitable mechanism, so that when the piston is drawn backward, coal falls in front of it, and is pushed into the feed-box on the forward stroke of the piston, and then gradually into the retort, as more coal follows. Through the combined action of the pusher and the revolutions of the retort, aided, if necessary, by an inclination of the latter towards the discharge end, the coal is gradually distilled before it arrives at the discharge end.

At the bottom of the discharge-box is an outlet of comparatively small area and of cylindrical or other shape, to which is attached a tube, which may have similar valves inserted as the feed-pipe, and which discharges its contents direct into a tank or in a creeper, by which the discharge is removed mechanically or in any other ordinary way, the mouth of the tube dipping, if desired, under water. It is preferable, however, to insert a similar contrivance as the feed-cylinder, with pusher or piston in any convenient position in this discharge-pipe, so as to project the red-hot coke, as soon as possible after its discharge from the retort, direct on the fire-grate for heating the retort, the only difference between this stoking cylinder and the feed cylinder being that the stoker has some lateral space through which that part of the coke which is not required for heating the retort may pass the pusher, and be discharged in the same way as before described. The coke outlet from the cylinder may be fitted with a cone valve worked automatically, in lieu of or in addition to cocks and hydraulic dips.

In order that there may always be a sufficient quantity of coke for the pusher to operate upon, a throttle-valve may be inserted immediately below, which may be regulated by hand. The surplus coke may also be removed by a creeper or other mechanical means to the general storing place.

Instead of extinguishing the heat of the red-hot coke with water, the coke may be discharged into a closed cylinder in direct communication with the discharge-pipe, which cylinder contains an archimedian screw or other suitable means of movement or mechanism, and is surrounded by a water or air space constituting a stream of hot water, boiler, or air-heating apparatus. Air being excluded from the coke, it will not burn, but give off its heat gradually to the surfaces, along which it is continually being moved by the action of the creeper. The discharge-pipe and other portions containing hot coke may be surrounded by water or air spaces where such is desirable.

To seal up any gas that may find its way into the closed discharge cylinder just described, and to prevent influx of air, the continuity of the creeper may be broken and a water dip interposed; or the coke may be discharged into a tank containing water, under the surface of which the discharge end of the creeper casing dips.

The pistons, screws, and valves are actuated by mechanical power in any ordinary way, their speed and other adjustments being regulated by hand from time to time, as circumstances require, or by such mechanical means as may be available for the purpose.

Where retorts are set in benches, those of one bench may be connected to the same common casing at each end—*i. e.*, feed and discharge-box each retort having its own feed, but all having, of course, only one common stoker.

It is clear that, instead of carrying on the whole process mechanically and automatically from receiving the coal to storing the surplus coke, as here described, a part of the process only may be so carried on, other portions being attended to by hand; and, further, that some one or more of these improvements may be applied without adopting all.

4666.—Proud, T., Birmingham, "*Improvements in apparatus used in the purification of gas.*" Provisional protection only obtained. Dated Dec. 8, 1877.

This invention has for its object the construction and arrangement of apparatus in an economical manner, whereby coal gas may be purified and rendered practically free from ammonia, and consists in making a rectangular vessel of any convenient height with an internal vertical gas and water tight partition, extending from the bottom to the top, thus dividing the vessel into two separate chambers. Within these chambers there are a series of surface board grids, each alternate one being placed at right angles to those immediately above and below it. At or near the bottom of one of the chambers there is an inlet for the gas, and at or near the top of this chamber there is fixed an internal or external pipe or conduit, connecting it with the lower part of the next chamber, an exit for the gas being formed at the upper part of this second chamber. Above these chambers there is another vessel, which, for the sake of symmetry, is preferably made of the same area as that beneath it. This vessel has also a water-tight partition extending from the bottom to the top, so as to form it into two cisterns, one to contain ammoniacal liquor, and the other clean water.

The use of the apparatus is as follows:—One cistern being supplied with ammoniacal liquor, and the other with plain water, the ammoniacal liquor is allowed to pass and be distributed by any convenient arrangement into the chamber beneath it, so that the surfaces of the board grids are kept wet by the constant dripping of the liquor from above. Gas is admitted from the inlet, and in its course upwards it is broken up into an immense number of streams, each of which is brought into contact with the liquid and wetted sides of the grids. This has the effect of removing much of the ammonia, but inasmuch as some of the ammonia would still remain in the gas, it is caused to descend by the connecting-pipe and enter the second chamber, where it meets a similar treatment with pure water, which descends in the same manner from the water-cistern above.

It will be seen that by this arrangement the foul gas is brought first into contact with the strong liquor, and as it proceeds forward and becomes purer, it meets liquor of less and less strength, until in the upper part of the second chamber it is subjected to the action of pure water only, when the whole of the ammonia will have been removed from the gas, which may then pass on to the purifiers or other apparatus.

Instead of the cisterns being placed above the chambers they may be arranged in any other convenient position, and the liquor and water transmitted to them through pipes, and be distributed either by gravitation or by the assistance of a force pump.

The apparatus is not limited to two chambers only, since the vessel before described may be increased in size, and divided into any convenient number of chambers, each having an internal or external pipe or conduit connecting its upper part with the lower part of the next following one. The order, too, in which the ammoniacal liquor and water is supplied may be varied.

Share List of Gas and Water Companies.

(Corrected by Mr. Arthur G. Prater, 23, Cornhill, from the latest Stock Exchange Quotations.)

Number of Shares issued.	Amount per Share.	Name.	Amount paid up per Share.	Last Divd. p.Cent. p. Ann.	Latest Quotations.
	£	Gas Companies.	£ s. d	£ s. d	£
589892	10	Alliance and Dublin	10 0 0	10 0 0	15½—16½
10000	20	Anglo-Romano . .	20 0 0	10 0 0	21—23
5000	20	Bahia (Limited). .	20 0 0	4 0 0	12½-3½xd
1500	20	Do., 2nd pref. .	20 0 0	7 10 0	20-22 xd
40000	5	Bombay (Limited).	5 0 0	7 10 0	5¾—6
10000	5	Do., fourth issue.	4 0 0	7 0 0	¼—¾
10000	10	Bournemouth . . .	10 0 0	8 0 0	13½—14½
229700	..	Brentford	100 0 0	9 0 0	150—155
..	..	Do., 5 per ct. pref.	100 0 0	5 0 0	95—100
..	20	Do., C shares . .	16 0 0	9 0 0	6—8 pm.
5400	20	Brighton	20 0 0	10 0 0	32—34
5000	20	Brighton and Hove	20 0 0	10 0 0	32—34
14000	20	British (Limited) .	20 0 0	10 0 0	34—36
7223	20	Cagliari (Limited).	20 0 0	7 0 0	16—18
1500	10	Colney Hatch . .	10 0 0	5 0 0	8—9
5500	0*l.* Sk.	Commercial	100 0 0	10 10 0	178—182
70000	*l.* Sk.	Do., 7 per cent. .	100 0 0	7 10 0	124—127
20000	20	Continental Union.	20 0 0	6 10 0	17—18
22000	20	Do., new	14 0 0	6 10 0	3½-2½dis.
10000	20	Do., preference .	20 0 0	7 0 0	22—23
75000	*l.* Sk.	Crystal Palace Dist.	100 0 0	10 0 0	168—172
12	0000 *l.* Sk.	Do., 7 per cent. .	100 0 0	7 0 0	118—122
80000	*l.* Sk.	Do., preference .	100 0 0	6 0 0	115—120
25000	6	Do., ord. 7 p. c. .	1 4 0	7 0 0	¼—1 pm.
7100	25	Edinburgh	25 0 0	10 0 0	46—48
23406	10	European (Limited)	10 0 0	10 10 0	16½-¾xd
12000	10	Do., new shares.	7 10 0	10 10 0	4—¼ pm.
33406	10	Do., new shares .	5 0 0	10 10 0	2¾-3 pm.
4096300	*l.* Sk.	Gaslight & Coke A.	100 0 0	10 10 0	177—180
100000	*l.* Sk.	Do. B.	100 0 0	4 0 0	70—75
50000	10	Do. 5 per ct. pref. conv., 4th issue.	10 0 0	5 0 0	16½-17½
50000	10	Do. do., 5th do. .	10 0 0	5 0 0	15½-16½
2000000	*l.* Sk.	Do. C 10 p.c. pref.	100 0 0	10 0 0	206—211
3000000	*l.* „	Do. D do. do. .	100 0 0	10 0 0	206—211
1650000	*l.* „	Do. E do. do. .	100 0 0	10 0 0	206—211
80000	*l.* „	Do. F 5 do. do. .	100 0 0	5 0 0	100—103
60000	*l.* „	Do. G 7½ do. do. .	100 0 0	7 10 0	150—155
1300000	*l.* „	Do. H	100 0 0	7 0 0	130—134
589892	10	Georgetown, Guiana	5 0 0	7 0 0	4—4½
300000	100	Glasgow Corporation Gas	100 0 0	9 0 0	205—210
115000	100	Do., do. . . .	100 0 0	6 15 0	155—160
..	100	Grimsby Gas, A . .	100 0 0	..	186—190
..	10	Hampton Court . .	10 0 0	10 0 0	14—15
7000	10	Hong Kong (Lim.)	10 0 0	10 0 0	15—16
5000	10	Hornsey	10 0 0	10 0 0	14—15
2000*l.*	100	Imperl. Continental	100 0 0	10p.c.& 2 p.c. bonus	166—169
..	..	Kingston	..	..	..
..	..	Lea Bridge	..	..	11½—12½
9000	4	Limerick Gas . . .	4 0 0	3 15 0	2—2½
56100*l.*	100	Liverpool United .	100 0 0	..	180—185
1691000*l.*	100	Do., B	100 0 0	7 0 0	125—135
3865000*l.*	Sk.	London	100 9 0	10 0 0	170—173
1500000*l.*	Sk.	Do., 1st pref. . .	100 0 0	6 0 0	123—126
7622	25	Do., A shares . .	25 0 0	6 0 0	28—30
266924*l.*	Sk.	Do., Debent. stk.	100 0 0	5*l.* & 6*l.*	..
15000	5	Malta and Mediterranean (Limited).	5 0 0	2 10 0	2—¼
..	..	Do., preference .	5 0 0	7 10 0	4½—5
30000	5	Mauritius (Limited)	2 5 0	3 6 8	1⅞-1¼ dis
20000	5	Monte Video (Lim.)	20 0 0	8 0 0	14-15 xd
25000	20	Nictheroy, Brazil (Limited)	10 0 0	5 0 0	3—4
8000	10	Oriental (Calcutta).	3 10 0	9 0 0	¼—1 pm.
30000	5	Do., new shares .	3 10 0	9 0 0	¼—1 pm.
10000	5	Ottoman (Limited).	5 0 0	3 0 0	2—2½
10000	5	Pará (Limited) . .	10 0 0	3 0 0	4—5
27000	20	Phœnix	20 0 0	10 0 0	33½—34½
3600000*l.*	100	Do., new max. 7½	80 0 0	7 10 0	106—110
1440000*l.*	Sk.	Do., capitalized .	100 0 0	5 0 0	92—96
..	20	Do., new, 1876. .	16 0 0	10 0 0	11-13pm
..	..	Richmond (Surrey)	..	..	15—16
37500	20	Rio de Janeiro (L.)	20 0 0	10 0 0	23½—24½
1500	32½	Shanghai	32 10 0	12 0 0	..
..	100	Sheffield, A . . .	100 0 0	10 0 0	192—194
Do., C	100		100 0 0	10 0 0	106—108
442	100	New River	100 0 0	7 0 0	320—350
4475	100	Do.	85 0 0	7 0 0	280—300
400000	100	Do., deb.sk., 4p.c.	100 0 0	4 0 0	101—103
666800*l.*	100	Southwrk & Vauxh.	100 0 0	5 0 0	130—133
324700*l.*	100	Do., pref. stock.	100 0 0	5 0 0	119—121
126500*l.*	100	Do., D shares. .	100 0 0	4 0 0	127—130
700000*l.*	100	Do., new ordnry.	..	4 10 0	..
1600	100	Do., nw.ord.No.1	40 0 0	4 10 0	..
15073	61	West Middlesex .	61 0 0	6*l.* p.sh.	145—147
12500	5	Singapore (Lim.) .	5 0 0	7 10 0	5½—6
2000	5	Do., preference.	5 0 0	7 10 0	5¼—6
500000	Sk.	South Metropoltn.	100 0 0	11 10 0	193—196
15000	10	Surrey Consumers	10 0 0	10 0 0	17—18
10000	10	Do., new. . . .	8 0 0	10 0 0	7—8 pm.
..	5	Tottenham & Edmonton	5 0 0	10 0 0	8½—8¾
1500	10	Wandsw. & Putney	10 0 0	10 0 0	14½—15
1500	10	Do.	10 0 0	7 10 0	10½—11½
4000	10	Do.	10 0 0	7 0 0	..
26000	5	West Ham	5 0 0	10 0 0	8—9
..	..	West Kent	..	..	13—14
..	..	Woolwich, Plmstd. and Charlton . .	..	10 15 0	..
		Water Companies.			
615600	100	Chelsea	100 0 0	6 0 0	153—155
1624700	100	East London . . .	100 0 0	6 0 0	163—165
10798	50	Grand Junction . .	50 0 0	5 0 0	87—89
5840	25	Do., ¼ shares . .	25 0 0	5 0 0	43¼—44¼
6160	25	Do., new ditto; max. div., 7½ p.c.	25 0 0	5 0 0	38—40
5551807.	100	Kent	100 0 0	8 0 0	210—215
781800*l.*	100	Lambeth	100 0 0	6 5 0	154—157
326150*l.*	100	Do., max., 7¼ p.c.	100 0 0	6 5 0	151—154
442	100	New River	100 0 0	7 0 0	320—350
4475	100	Do.	85 0 0	7 0 0	280—300
400000	100	Do., deb.sk., 4p.c.	100 0 0	4 0 0	101—103
666800*l.*	100	Southwrk & Vauxh.	100 0 0	5 0 0	130—133
324700*l.*	100	Do., pref. stock.	100 0 0	5 0 0	119—121
126500*l.*	100	Do., D shares. .	100 0 0	4 0 0	127—130
700000*l.*	100	Do., new ordnry.	..	4 10 0	..
1600	100	Do., nw.ord.No.1	40 0 0	4 10 0	..
15073	61	West Middlesex .	61 0 0	6*l.* p.sh.	145—147

APPLICATIONS FOR LETTERS PATENT.

2922.—Wilson, T. and G., Glasgow, "Improvements in pumps for pumping, compressing, or forcing air, water, gas, or other fluids or liquids." July 18, 1879.

2946.—Morgan-Brown, W., Southampton Buildings, London, "Improvements in water-meters, also applicable to measuring steam." A communication. July 19, 1879.

2975.—Hutter, H., Graz, Austria, "Improvements in fluid-meters, parts of which improvements are also applicable to motive power engines and pumps." July 22, 1879.

3046.—Galli, C. and J., Leeds, Yorks, "Improvements in gas-stoves for cooking purposes." July 25, 1879.

3057.—White, W., Wimpole Street, London, "Improvements in water regulating and waste preventing, and in the adaptation of same to the service of lavatories, closets, and such like purposes." July 26, 1879.

PATENTS WHICH HAVE PASSED THE GREAT SEAL.

309.—Pieper, C., Berlin, "A gas-power locomotive for tramways and for railways of secondary order." A communication. Jan. 25, 1879.

427.—Dubos, C., Paris, "Improvements in electric lamps." Feb. 3, 1879.

523.—Bousfield, E. T., Bedford, and Bousfield, W. R., Bristol, "Improved apparatus for obtaining electric currents, and means for obtaining light from electric currents." Feb. 10, 1879.

947.—Haddan, H. J., Westminster, "Improvements in apparatus for electric lighting." A communication. March 11, 1879.

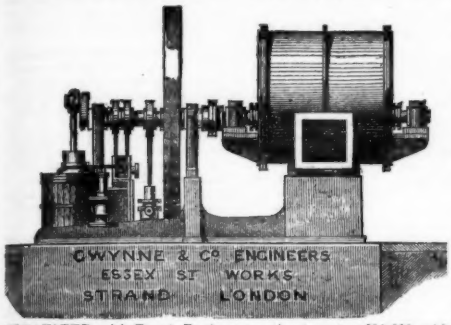
1500.—Linford, C., Leicester, "Improvements in gas-engines." April 17.

1933.—Sombart, C. M., Magdeburg, Germany, "Improvements in gas-engines." A communication. May 14, 1879.

1958.—Duffield, S., Darlaston, Stafford, "Improvements in the manufacture of gas, steam, and water fittings, such as tees, elbows, and crosses." May 16, 1879.

The GRAND MEDAL of MERIT at the VIENNA EXHIBITION, TWO MEDALS at the PHILADELPHIA EXHIBITION and TWO MEDALS at the PARIS EXHIBITION, have been AWARDED to GWYNNE & CO. for GAS-EXHAUSTERS, ENGINES, and PUMPS; Also 27 OTHER MEDALS AWARDED at all the GREAT INTERNATIONAL EXHIBITIONS.

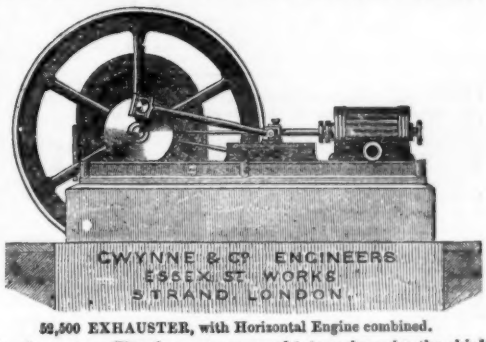
GWYNNE & BEALE'S PATENT GAS-EXHAUSTERS & ENGINES.



EXHAUSTER with Trunk Engine, capable of passing 210,000 cubic feet per hour.

The Judges report on the combined Exhauster and Steam-Engine exhibited at the Philadelphia Exhibition is—"*Reliable compact Machine, well adapted for the purpose intended, of excellent workmanship.*"

GWYNNE & CO. have made the largest and most perfect Gas-Exhausting Machinery in the world, and have completed Exhausters to the extent of 8,000,000 cubic feet passed per hour, of all sizes from 2000 to 210,000 cubic feet per hour.



52,500 EXHAUSTER, with Horizontal Engine combined.

GWYNNE & CO. do not pretend to enter into a struggle with other makers in respect to cheapness. They have never sought to make price the chief consideration, *but to produce machinery of the very highest quality, and most approved design and workmanship.* The result is that in every instance their work is giving the fullest satisfaction. Numerous testimonials and references can be given to Companies using their Machinery for years past.

Exhausters, with or without Engines combined, can be made to pass the gas WITHOUT OSCILLATION OR VARIATION IN PRESSURE Regulators, Bye-Passes, Stop-Valves, Gas-Valves, Station Governors, and Gas Machinery of all Sizes.

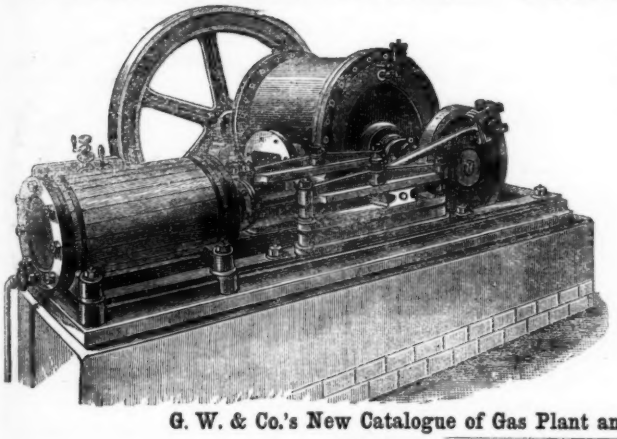
PLEASE ADDRESS IN FULL, GWYNNE & CO., Hydraulic and Gas Engineers, ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON, W.C., ENGLAND.

Gwynne & Co.'s New Catalogue on Gas-Exhausting and other Machinery may be obtained on application at the above Address.

BEALE'S IMPROVED PATENT GAS EXHAUSTERS,

WITH

Wrought-Iron Spindles and ENGINES COMBINED.



SOLE MAKERS,

GEORGE WALLER & CO.

MAKERS OF ENGINES, EXHAUSTERS, INDEX AND DISC GAS-VALVES, HYDRAULIC MAIN VALVES, BYE-PASS VALVES, TAR, LIQUOR, AND OTHER PUMPS, SCRUBBERS AND PURIFIERS, CONDENSERS, BOILERS, &c.

G. W. & Co.'s New Catalogue of Gas Plant and Machinery can be had on application.

Phœnix Engineering Works:

HOLLAND STREET, SOUTHWARK, S.E.

WANTED, Readers of the NEW Edition, 1879, "Cooking & Heating by Gas;" on Burners, &c. Copies, by post, Threepence, direct from the Author, Magnus Ohren, A.I.C.E., Gas-Works, Sydenham, S.E.

WANTED, by Advertiser, aged 21, a Situation in a Gas-Works, as ASSISTANT to the Engineer. Good Draughtsman and Chemist. Address No. 565, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

READING GAS COMPANY.

WANTED at once, a thoroughly good second-Hand STATION-METER for about 30,000 feet per hour.
Apply, with full particulars, to Mr. E. Baker, Engineer.

AN Engineer of large experience is in want of an Engagement as MANAGER or SECRETARY and MANAGER of a medium-sized Gas-Works. Manufacture of Residuals a specialite. Would go abroad. Payment by results. Testimonials and references to previous employers.
Address No. 567, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, a Re-engagement as MANAGER or ASSISTANT-MANAGER of a Gas-Works. 15 years practical experience. Satisfactory reason for wishing to change.
Address G. L., care of W. Layton, 277, Tabard Street, Borough, S.E.

A Gentleman (Assoc. Inst. C.E.), 29 years of age, wishes to obtain a Re-engagement as Engineer-in-Chief to a Gas Company abroad. Has had nine years experience in Gas matters, and received his professional education in two of the largest Gas-Works in Europe, and was employed for three years as Chief Engineer to a Gas Company abroad.
Address W. R. J., care of T. H. Devonshire, Esq., Solicitor, 1, Frederick's Place, Old Jewry, London, E.C.

FOR SALE.—A First-class Tar Factory, with Benzole Refinery attached; the whole erected within the past three years, and in the best possible condition. Doing a business of 3000 to 4000 tons per annum. The factory is situated on its own wharf in a first-class harbour. Satisfactory reasons for disposal.
Principals or solicitors only in first case, apply by letter addressed No. 563, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

WANTED, by a Young Man, aged 23, a Situation in a Gas-Works. Five years experience in a works making 80 millions. Can use Photometer, fair Draughtsman, good writer, quick at figures, and thoroughly understands general routine.
Address Z., 115, Westfield Street, St. Helen's, Lancs.

WANTED, a Yard Foreman, capable of looking after Engines and Exhauster. Also able to superintend Main Laying. A Smith preferred.
Apply, by letter only, stating wages required, and enclosing copies of testimonials, to No. 568, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

GASHOLDER FOR SALE.

THE Sleaford Gas Company, Limited, have for disposal a GASHOLDER, 32 ft. in diameter by 14 ft. deep, with Counterbalance Weights and Chains, Stone Columns, 5-in. Inlet and Outlet Pipes, Syphons, and Slide-Valves, all complete; the whole in splendid condition, and at present in use. To be moved to make room for extensions.
Can be seen, and full particulars obtained, on application to the undersigned.

By order,
Harry Wimhurst, Manager.

DRY GAS-METERS.

WE have a large extra Stock of these, in three, five, and ten lights, of the best make, that we can offer at less than half the list price. Have been tested by the City Gas Inspector. Also a few 100 to 300 lights, equally low in price.

HODGE AND Co., Gas Engineers, 100 and 101, Hatton Garden, LONDON, E.C.

EXHAUSTER FOR SALE.

FOR SALE, an Engine and Exhauster combined, to pass 7000 feet per hour, together with Boiler, 12 ft. by 4 ft., Boiler Fittings, Connections, Regulator, and Stone Bed.

For particulars, apply to W. T. TEW, Gas-Works, WARWICK.

TO BE SOLD, Cheap, Three Telescopic GASHOLDERS, two 60 ft. diameter and 20 ft. deep each lift, and one 70 ft. in diameter and 20 ft. deep. Only been in use eight years. May now be seen at work at the Effingham Street Gas-Works, Sheffield.

For price, apply to THOMAS PIGGOTT AND Co., Spring Hill, BIRMINGHAM.

TENDER required to furnish 250 yards of 15-in. METAL MAINS. 250 Yards of 8-in. METAL MAINS. Also a few Bends and Tees of each sizes.

To be addressed to Mr. BAILEY, Manager, Gas and Coke Company, EAST RETFORD.

TANKS.—Several stout square wrought- iron TANKS, from 2000 to 3000 gallons, suitable for Tar, Anthracine, Oil, &c., are for sale, cheap. Also several Pressure Boilers, 6 ft. by 4 ft., suitable for Benzole or Naphtha, Rectifying, &c.; Office Furniture, Platform Weighing-Machine, and Sundries.

Address No. 562, care of Mr. King, 11, Bolt Court, Fleet Street, LONDON, E.C.

GAS PLANT FOR SALE.

A 10-in. Vertical Pipe Condenser, having 20 Pipes, each 19 ft. high, on Cast-Iron Base Box.

A Scrubber, 16 ft. high 5¼ ft. diameter, fitted with thin boards, Self-Acting Liquor Distributor, 10-in. inlet and outlet pipes.

Two Single-Flue Cornish Boilers (new in 1870), each 9½ ft. long, 3 ft. 9 in. diameter; Fire Tube of Low Moor Iron, complete with all Fittings.

All in good working order; removed to make room for larger plant.

For further particulars apply to THOS. TREWHITT, Gas-Works, WEST HARTLEPOOL.

May 8, 1879.

TO TAR DISTILLERS.

THE Directors of the Brentford Gas Company are prepared to receive TENDERS for the purchase of the Surplus TAR produced at their Brentford and Southall Works for the period of One year, from the 1st day of October next. Approximate quantity 600,000 gallons.

Sealed and endorsed tenders to be sent in not later than the 16th inst.

For further information, apply to Frank Morris, Engineer, Brentford Gas Company.

By order,
WILLIAM CROXFORD, Secretary.

Gas Office, Brentford, Aug. 1, 1879.

WIGAN GAS-WORKS.

THE Gas Committee of the Corporation are prepared to receive TENDERS for the Supply of 40,000 Tons of Best GAS COAL, delivered at the Gas-Works in such quantities as may be required by the Manager during the Two years from Oct. 1, 1879, to Oct. 1, 1881.

The Committee expect to have a railway siding into the Gas-Works in a short time.

Tenders to be addressed and delivered to the Town Clerk, Wigan, endorsed "Tender for Coal," on or before the 5th of August next, at Twelve o'clock at noon.

Tenders not endorsed will be rejected.

The Committee do not bind themselves to accept the lowest or any tender.

MASKELL WM. PEACE, Town Clerk.

July 23, 1879.

THE Gloucester Gas Company, ceasing to manufacture gas at their old works, will have the undermentioned APPARATUS for Sale about the beginning of August, viz.:—

110 Mouthpieces, D-shape, 13 in. by 22 in., with Wrought-Iron Lids, Cross-Bars, Stand, Bridge, and Dip Pipes. Also about 150 feet of D-shape Wrought-Iron Hydraulic Main, size 19 in. by 19 in. 28 Mouthpieces, D-shape, 16 in. by 20 in., with Wrought-Iron Lids, Cross-Bars, Stand, Bridge, and Dip Pipes. Also about 38 ft. of D-shaped Wrought-Iron Hydraulic Main, size 20 in. by 20 in. Annular Condenser, consisting of six Vertical Pipes, 24 in. diameter, 19 ft. high, with three 12 in. Slide-Valves and 12 in. Connections.

Scrubber (round), 5 ft. by 20 ft., with three 12-in. Slide-Valves, and 12 in. Connections.

Exhauster (Jones) to pass about 15,000 feet per hour.

Exhauster (Beales) to pass about 25,000 feet per hour.

Two Vertical Steam-Engines, each about 6-horse power, with Pulleys, and Shafting used for driving the above.

Boiler 14 ft. 6 in. by 3 ft. 6 in., with Centre Tube, and four Galloway Patent Tubes.

4-horse power Horizontal Steam-Engine.

Three 4-in. Pumps, with cranked Shafting and a pair Mitre Wheels.

Set of four Purifiers, 12 ft. by 12 ft. by 4 ft., with 12-in. Centre-Valve (Cockeys), and Connections and Lift complete.

Station-Meter by A. Wright and Co., London, with three 12-in. Slide-Valves, and 12-in. Bye-Pass and Connections, to pass about 25,000 feet per hour.

Gasholder, Double Lift, with Cast-Iron Tank, capacity 37,000 feet.

Gasholder, Double Lift, capacity 100,000 feet.

Gasholder, Double Lift, capacity 240,000 feet.

Two 12-in. Governors, by Wright, London, with 12-in. Valves, Bye-Pass, and Connections.

Two 12-in. four-way faced Valves, by Cockey.

For further information, &c., apply to the undersigned.

R. MORLAND, Engineer.

THE GASLIGHT & COKE COMPANY.

Chief Office, Horseferry Road, Westminster, S.W.,
July 29, 1879.

NOTICE is hereby given that a HALF-YEARLY ORDINARY GENERAL MEETING of the PROPRIETORS in this Company will be held at this Office, on FRIDAY, the 15th day of August next, at Twelve o'clock (noon) precisely, to transact the usual business, including the declaration of a Dividend for the half year ending the 30th day of June last.

Notice is hereby also given that at such meeting the Directors will apply to the Proprietors for authority to dispose of such further portions of the Company's property as is not now required for the purpose of their undertaking.

By order,
JOHN ORWELL PHILLIPS, Secretary.

TENDERS.

THE Devonport Gas and Coke Company are prepared to receive TENDERS for Repair of GASHOLDER; and also for the Removal of a Telescopic GASHOLDER and FRAME.

Specifications may be had on application.

JOHN WILLING, Secretary.

Aug. 2, 1879.

TENDERS FOR COAL.

THE Ludlow Union Gas Company re- quire 1000 tons of best GAS COAL between the present time and June 30, 1880.

Tenders to be sent, giving price delivered carriage free at Ludlow Station, to Mr. MONTFORD, Secretary, Ludlow Union Gas Company, Ludlow, SALOP.

The lowest tender will not necessarily be accepted.

TO IRONFOUNDERS.

THE Gas Committee of the Padiham and Hapton Local Board require TENDERS for the Supply of about 2460 Yards of 4-in. Turned and Bored PIPES, &c.

Particulars may be had on application to Mr. J. R. Smith, Gas Manager, Padiham.

Sealed tenders, endorsed, to be sent in on or before the 13th of August, addressed

ROBT. DUCKWORTH, Clerk to the Board.

Padiham, Aug. 1, 1879.

GAS APPARATUS FOR SALE.

THE Bury St. Edmund's Gas Company have FOR SALE One Circular STATION-METER with 8-in. Connections; to pass 8000 cubic feet per hour.

One 9-in. GOVERNOR, with water, ballast, and air-chamber.

Connections and valves complete for the above.

Further particulars may be learned on application to

JOHN M'CRAE.

Gas-Works, Bury St. Edmund's.

THE Peterborough Gas Company require TENDERS for the Purchase of the Surplus TAR produced at their Works for One year, ending June 30, 1880. The Tar to be delivered by the Company into the Contractor's tank trucks at the Great Northern Railway Station, Peterborough.

Tenders to be delivered to me on or before Monday, the 18th of August inst.

G. E. STEVENSON, Engineer and Manager.

Gas-Works, Peterborough.

DARWEN CORPORATION GAS-WORKS.

TO COLLIERY PROPRIETORS—TENDERS FOR GAS COALS.

THE Gas Committee of the above Cor- poration invite TENDERS for the Supply of from 7000 to 8000 Tons of Best GAS COALS per year for One, Two, or Three years, commencing about the 1st of November next.

Specifications and forms of tender may be obtained from the undersigned; but tenders, endorsed "Tender for Gas Coal," to be delivered to C. Costeker, Esq., Town Clerk, Darwen, on or before Monday, Aug. 11, 1879.

By order,
THOS. DUXBURY, Manager.

Gas-Works, Darwen.

Price 28s., handsomely bound in Morocco, cloth sides, gilt edged and lettered.

THE FIRST VOLUME
OF
KING'S TREATISE

On the Science and Practice of the Manufacture and Distribution of

COAL GAS.

Edited by THOS. NEWBIGGING, C.E., M.Inst.C.E., and W. T. FEWTRELL, F.C.S.

Orders received by
WALTER KING, 11, Bolt Court, Fleet Street, London, E.C.

Prices, half bound, cloth sides, 2 quires, 30s.; 3 quires, 36s.; other sizes and bindings to order.

THE
GAS COMPANIES EXPENDITURE JOURNAL,

Being a Ruled Account-Book with Printed Headings, and Analyzing Guide for Keeping, upon the easiest and most correct method, the Expenditure of a Gas Company, in accordance with the provisions of the Gas-Works Clauses Act of 1871, and suitable for all Companies.

Specimen, with illustration and full particulars; 2s. 6d. returned on the purchase of a "Journal."

Published by SANDELL AND SON, Accountants, 2, Great George Street, WESTMINSTER, and W. KING, Office of the JOURNAL OF GAS LIGHTING, 11, Bolt Court, FLEET STREET, E.C.

TOWN of LLANTRISSANT, GLAMORGANSHIRE.

VALUABLE GAS-WORKS FOR SALE.

MESSRS. Stephenson, Alexander, & Co. are instructed to sell by Auction, by order of the Mortgagees, in One Lot, at the Royal Hotel, in the town of Cardiff, in the county of Glamorgan, on Aug. 19, 1879, at Two o'clock precisely in the afternoon, the following valuable and well-constructed Freehold and Leasehold Gas-Works, the property of the Llantrissant Gaslight and Coke Company, Limited, viz.:—

All that piece of Freehold Land containing an area of 1622 Square Yards or thereabouts, together with the Gas-Works and Manager's Dwelling-House erected thereon, and all the Plant, consisting of Gasholder, Retorts, Purifiers, Condenser, Scrubber, Governor, Steam-Boiler, Exhauster, Mains, and other Machinery usually employed in the Manufacture and Supply of Gas. Also all that piece of Leasehold Land containing an area of half an acre or thereabouts, together with the Gas-Works, Cottage, and similar Machinery to the above. Also Pillars and Brackets with Lamps for Lighting Public Streets, and a large quantity of Meters and several thousand yards of Mains. Also about 198 Yards of 3-in. Cast-Iron Pipe in 9 ft. lengths, stowed at the Works.

The leasehold premises are held for a term of 99 years from Aug. 2, 1875, under a lease granted by Vaughan Hanning Vaughan Lee, Esq., M.P., at the yearly rent of £20.

The freehold and leasehold Works are connected, and gas can be supplied to the whole of the district of supply from both or one of them.

The freehold Gas-Works have been in operation for upwards of 12 years, and the leasehold portion was recently added to meet the increased requirements of the district.

The town of Llantrissant is situated within the South Wales mineral basin, and is 12 miles distant from Cardiff.

The works have been supplied with superior gas coal from neighbouring collieries at moderate prices, and gas is supplied to the stations of the Llantrissant and Taff Vale Junction Railway, and to the station, offices, and signals of the Great Western Railway at Llantrissant, besides a large tin-works and waggon works and the houses in the town of Llantrissant, and the villages in the immediate neighbourhood thereof.

Further particulars, plans, and conditions of sale can be had of Messrs. SPICKETT AND PRICE, Solicitors, Pontypridd, GLAMORGANSHIRE.

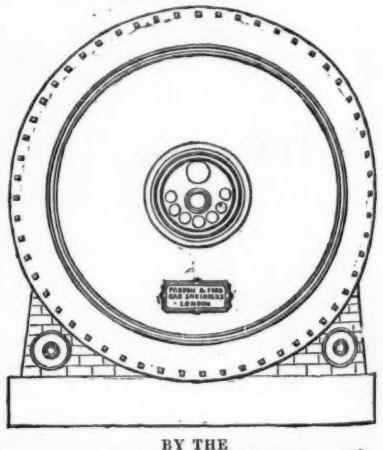
CLOTH GAS-BAGS FOR MAINS,

As supplied to the Imperial, Chartered, and other London and Provincial Gas Companies. Bellows and Valves for inflating Well Dresses, Stokers Gloves, India-Rubber Suction and Delivery Hose, Gas-Tubing, Leather, India-Rubber, and Gutta-Percha Machine-Bands, Sheet and Washers, and Steam Joints.

T. BUGDEN, Manufacturer,
107, GOSWELL ROAD, LONDON, E.C.

STATION METERS,

With or without Cast-Iron Stands,



BY THE
IMPERIAL METER CO.,
LIMITED.
(Formerly Walter Ford, at Gray's Inn Road),
KING'S ROAD, ST. PANCRAS,

Manufacturers also of
THE IMPROVED DRY METERS,
CONSUMERS Patent Compensating WET METERS,
Special Meters for Public Lighting, and of
GOVERNORS,
ETC., ETC.

TO INVENTORS AND PATENTEES.

MR. W. H. BENNETT, having had considerable experience in matters connected with Gas, Water, and Sanitary Improvement, begs to say that he continues to assist Inventors in the perfection of their designs, and to obtain for them PROVISIONAL PROTECTION, whereby their invention may be secured for Six Months; or LETTERS PATENT, which are granted for Fourteen Years.

Patents completed, or proceeded with at any stage, thereby rendering it unnecessary for persons resident in the country to visit London.

Patents procured for Foreign Countries.

Information as to cost, &c., supplied gratuitously upon application to the Advertiser, 22, Great George Street, WESTMINSTER.

HENRY LYON (14 years Engineer and Manager of the largest of the Manchester Corporation Gas-Works) Mechanical and Consulting Gas Engineer, reports upon the condition and value of Gas-Works, supplies plans and specifications of all Apparatus appertaining to Gas-Works, and re-models existing Works.
Address Brooklyn, near Halliwell Lane, Cheetham Hill Road, MANCHESTER.

Mr. ROBERT DEMPSTER,
CONSULTING GAS ENGINEER,
ELLAND, near HALIFAX,
May be consulted on all matters connected with Valuations, Arbitrations, and Parliamentary Applications connected with Gas-Works. Having been engaged on extensive Arbitration Cases, which, combined with his experience in Construction and Contracting, his knowledge of Engineering and Valuations is both extensive and reliable.

A. FAIRLIE WILSON,
CONSULTING GAS ENGINEER,
34, ST. GEORGE'S ROAD, SOUTHWARK, S.E.
Reports and Valuations in the Management, Construction, and Structural Value of Gas-Works.

W. LIDDALL,
Public Accountant,
MOORGATE STREET CHAMBERS,
GREAT SWAN ALLEY,
MOORGATE STREET, E.C.

ALFRED LASS, F.I.Accts.,
SPECIAL ACCOUNTANT FOR GAS AND WATER UNDERTAKINGS,
30, GRACECHURCH STREET, LONDON.

Accounts Analyzed and Statistics Prepared for Parliamentary Proceedings, Arbitrations, &c.
The Forms of Account, which have been specially designed by Mr. Lass to meet the requirements of the Gas-Works Clauses Amendment Act, 1871, are now in use by many Gas Companies, Corporations, and Local Boards.

J. & H. ROBUS,
BUILDERS AND CONTRACTORS
FOR THE ERECTION AND REBUILDING OF GAS AND WATER WORKS,
RETORT-SETTING—A SPÉCIALITÉ.
ROBUS'S IMPROVED RETORT-SETTINGS, guaranteed to Carbonize a large amount of Coal with a small per cent. of Fuel.
ESTIMATES GIVEN FOR MAIN-LAYING.
N.B.—All kinds of Fire Goods and Gas Apparatus supplied on the shortest notice.
Address:—J. & H. ROBUS, BELL GREEN, CATFORD, LONDON, S.E.

JOHN ROMANS, C.E., F.G.S.E.,
CONSULTING GAS ENGINEER
AND
CANNEL COAL FACTOR,
30, St. Andrew Square, EDINBURGH.

Plans and Estimates furnished; Gas-Works, Apparatus, Pipes, Machinery, Fire Goods, &c., supplied, or Attested and Shipped for Exportation.
GAS-WORKS TAKEN ON LEASE.

Mr. ROMANS has for upwards of 30 years been practically engaged in the Manufacture of Gas, and has, by extensive experiments, ascertained that by JUDICIOUS INTERMIXTURE of the lighter with the heavier gases, much of the rich Hydrocarbons CAN BE SAVED, which otherwise ARE LOST, during the process of manufacture. He is therefore enabled to give advice to those who favour him with their orders for Cannel, as to the class which will secure for their standard of illuminating power the HIGHEST ADVANTAGEOUS RESULTS.

ANALYSIS AND PRICES FORWARDED ON APPLICATION.

KÖRTING'S STEAM-JET EXHAUSTER.
IMPROVED CLELAND'S PATENT.
UPWARDS OF 300 IN USE.
CLELAND'S SLOW-SPEED CONDENSER & STEAM SCRUBBER.
FOR PARTICULARS, APPLY TO
KÖRTING BROS.,
17, LANCASTER AVENUE, MANCHESTER,
OR TO
GERALD J. TUPP, Creek Engine-Works,
Middle Mall, Hammersmith, London, W.
SOLE AGENT FOR ENGLAND AND WALES.

TO MAKERS OF SULPHATE OF AMMONIA AND BUYERS OR SELLERS OF GAS LIQUOR.

F. SUTTON & CO., Norwich, are now prepared to Supply a Set of Apparatus with Standard Test Solutions for the rapid and accurate analysis of Gas Liquor, which can be used by any intelligent workman, so as to show the actual amount of Sulphate which can be got out of any sample of liquor in a few minutes, without any of the annoyance arising from saturation with acid, &c. Tables are also given, showing the quantity of acid of various strengths required for any given liquor, the accurate ounce-strength and percentage of pure ammonia, &c. Price of the set, with full direction and table (copyright), with materials sufficient for fifty analyses, £4 4s.
Post orders or cheques to be made payable to F. SUTTON AND CO., Manufacturing Chemists, NORWICH, who also supply every description of Standard Solutions for Volumetric Analysis of Waters, Beers, Manures, &c., of guaranteed accuracy.

ECONOMY IN THE PRODUCTION OF GAS, AND CARBON DEPOSIT ENTIRELY PREVENTED.
PLUTONIC CEMENT,
FOR JOINTING AND REPAIRING RETORTS AND OVENS *in* ACTION AND *out* OF ACTION.
A Pamphlet on the advantages of the above, with Modes of Application, References, Prices, &c., free by post, from the Sole Manufacturer,
WILLIAM RICHARDSON, Gas and Hydraulic Engineer, CHARLES HENRY STREET, and BISSELL STREET, BIRMINGHAM.

Now Ready, Price One Guinea,
PRECEDENTS IN PRIVATE BILL LEGISLATION
AFFECTING GAS AND WATER UNDERTAKINGS.
COMPILED BY MR. G. W. STEVENSON, C.E., F.G.S.

This Work contains information with regard to the practice of Parliament during the last fourteen years, in regard to most of the points on which differences arise in Opposed Bills for Gas and Water Undertakings, comprising—Authorized share and loan capital, Rates of dividend, Capitalization of profits, Term for the repayment of loans, Instances in which new shares are to be sold by auction and Exceptions to the Standing Order requiring new shares to be sold by auction, The limitation of back dividends, Illuminating power, Purity, Price, Notice before testing, The conditions under which the public supply of gas is regulated, Alteration of mains, Instances in which maps of mains are required, and All cases in which undertakings have been transferred, since 1845 in gas and 1865 in water, from Companies to Local Authorities.
In the Water Precedents will be found, in addition, The rates for a supply for domestic purposes, and the Rates for other than domestic purposes.
LONDON: WALTER KING, 11, BOLT COURT, FLEET STREET, E.C.

SULPHATE AMMONIA.
R. W. WALLACE & CO.,
60, MARK LANE, LONDON, E.C.,
Are Buyers of SULPHATE AMMONIA in Large or Small Quantities, or Sell on Commission for Gas Companies and Makers.
PLANT ERECTED ON THE LATEST AND MOST APPROVED PRINCIPLE.
AGENTS to THE GASLIGHT AND COKE COMPANY, LONDON, for the SALE of SULPHATE AMMONIA. Works: BECKTON.

WANTED, by Samuel Thompson & Co., Colliery Office, Lancaster, APPLICATION for PRICES from Gas Managers who are prepared to receive Tenders for GAS COAL or CANNEL.

John Leigh, Esq., M.R.C.S., F.C.S., &c., &c., in his analytical report of S. T. & Co.'s Coal, says: "It is remarkable for its purity, I have scarcely ever examined a Coal containing so small a quantity of ash, and when Cannel of the best description is scarce, it may well replace this material."

BELGIAN CLAY RETORTS.

J. SUGG and CO., late ALBERT KELLER, GHENT.—The removal of the import duties on Earthenware permitting the entry of Clay Retorts into England, Messrs. Sugg, of Ghent, beg to draw the attention of the Gas Companies of London, and other Cities, to the very superior quality of the RETORTS manufactured by them. They can be made of any size, in one piece, and of any form. The price will be in proportion to the weight, and very moderate in comparison to their value.

Communications addressed to J. SUGG & CO., GHENT, will receive immediate attention.

JAMES NEWTON & SONS,
(Established 1820,)
FIRE-BRICK AND TILE MERCHANTS,
Wholesale and for Exportation,
FALCON DOCK, 78 AND 79, BANKSIDE,
SOUTHWARK, LONDON, S.E.,
DEPÔT for STOURBRIDGE AND NEWCASTLE FIRE-BRICKS, LUMPS, TILES, and FIRE-CLAY, and every Article suitable for
GAS AND WATER WORKS.

S. PONTIFEX & CO.,
GAS AND WATER ENGINEERS,
22, COLEMAN STREET, LONDON, E.C.,

Supply and Erect Street Lamp Columns, together with Head Irons and Lanterns, as well as all the other fittings connected therewith.

S. P. & Co. also contract with Gas, Railway, and other Companies, Local Boards, and Vestries, for the maintenance and repair of Lamps and Fittings.

TORBAY AND DART PAINT COMPANY, LIMITED.

WORKS:
DARTMOUTH & BRIXHAM (TORBAY) DEVON.
OFFICES:
23, GREAT GEORGE STREET, WESTMINSTER
LONDON, S.W.

SOLE PROPRIETORS AND MANUFACTURERS OF
WOLSTON'S CELEBRATED
TORBAY IRON PAINTS.

TRADE MARK

These Paints have been for many years extensively used in Her Majesty's Royal Dockyards, Woolwich Arsenal, the Shorncliffe and Curragh Camps, War Departments, and Colonies, and are largely supplied to Railway, Harbour, and GAS COMPANIES, Shipowners, Engineering Establishments, Railway Carriage and Wagon Works, and the Paint Trade generally. They are the BEST PROTECTORS of WOOD, CEMENT, and IRONWORK, even arresting corrosion after it has set in; and their base being oxide of iron, they are free from those properties which make lead paints so destructive to iron. They do not scale or blister, are not affected by great heat, and are the only Paints which will resist the effects of sulphuretted hydrogen. Their DURABILITY and covering properties have borne the test of A QUARTER OF A CENTURY'S PRACTICAL TRIAL.

The undermentioned colours—ground in best linseed oil, and requiring only to be thinned down for use in the ordinary way—are kept in stock:—

Torbay Brown.	Torbay Red.
Dart Green.	Slate.
Dart Yellow.	Buff.
Brixham Black.	Torbay Chocolate.
Light Blue.	Cream Colour.
Dart Brown.	Dart Umber.
Imperial Stone.	Light Stone.
Bronze Green.	Salmon Colour.
Navy Green.	Lead Colour.
Carriage Red.	Dark Stone.
Light Lead.	Crystal Palace Blue.
Light Green.	Iron Grey.

All other Colours made to order.

READY-MIXED PAINTS.

A great variety of Colours ready mixed for the brush are also always kept in Stock, in 3 lb., 7 lb., 14 lb., and 28 lb. cans.

Prices and Testimonials on application.

GAS *v.* ELECTRIC LIGHT.

WIGHAM'S PATENT GAS-BURNERS

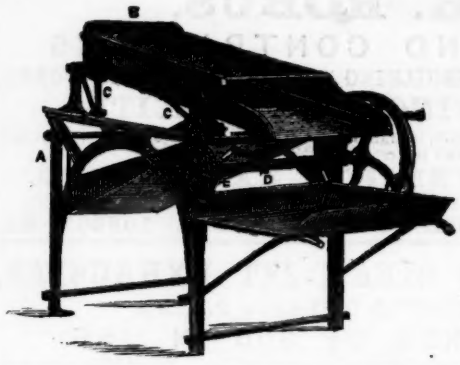
FOR

STREET LIGHTING, &c., WHICH REQUIRE NO GLASS CHIMNEY.

Speaking of these burners, erected on the Thames Embankment by Westminster Bridge, the *Daily News* says:

". . . . A blaze of light is thrown out, which, in point of efficiency and brilliancy, far surpasses the large gas-lamps lately erected in Waterloo Place, *while even the electric lights are quite thrown into the shade.*"

SOLE MANUFACTURERS:
J. EDMUNDSON & CO., GAS ENGINEERS,
19, GREAT GEORGE STREET, WESTMINSTER, LONDON, S.W.



PRICE'S PATENT
LABOUR-SAVING SCREEN OR SIFTER.

In screening breeze, the coarse material falls on a tray supported by the handles of the Machine, thus making it convenient for picking the clinkers from the same, whilst the fine falls on a shoot behind, which is fixed to the bottom of the sieve B. In screening gravel or other material, the coarse will fall into a barrow direct, and the fine be conveyed by the shoot into a barrow at the other end, or at the bottom.

To practical men the advantages of this Machine will be evident. It secures at once a saving of time, labour, and expense, as by it a much greater quantity of material can be sifted in the same space of time.

Further particulars as to price, &c., may be obtained by applying to the Patentee (Hampton Wick), or to

ROBERT DEMPSTER & SONS,
(SOLE MANUFACTURERS),
ELLAND, NEAR HALIFAX.

J. & J. BRADDOCK,
GLOBE METER-WORKS, OLDHAM,

MANUFACTURERS OF

WET AND DRY CONSUMERS GAS-METERS,

OF THE HIGHEST EXCELLENCE ONLY;

ROUND STATION-METERS,

ON CAST-IRON STANDS;

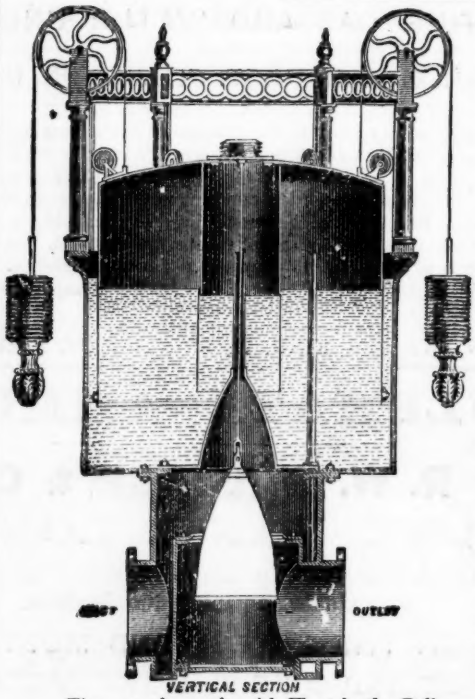
SQUARE STATION-METERS,

WITH PLANED JOINTS.

Messrs. BRADDOCK beg to submit to Gas Engineers their

PATENT COMPENSATING GAS GOVERNOR,

Which is designed to give an uniform pressure at the Outlet to the Main at all draughts up to the full quantities which the Governors are made to control, such outlet pressure being less than the initial pressure.



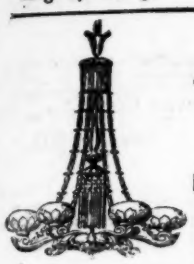
VERTICAL SECTION

The uniformity of pressure is obtained by introducing a compensating chamber into the Bell or Holder of the Governor, which compensator is of the same area as the valve, both of which are operated on by the initial pressure, thereby placing the valve in equilibrium, no matter what the initial pressure may be. The action on the Bell is by the Gas passing along a pipe from the outlet, and the pressure is regulated by weights in connexion with the Bell as required.

From the sectional elevation attached hereto, it will be seen that only the Gas required to operate the Bell comes in contact with the water of the tank, which water will remain comparatively sweet and free from odour. That in case of accident to the Bell, no more Gas can escape than would pass up the pipe covering the valve-rod and Bell supply-pipe.

These Governors have been made and sent out of various sizes for from 2 to 30-inch Mains, and give most satisfactory results.

They can be made with Float in the Bell, or counterpoise as per section.



F. & C. OSLER,

45, OXFORD STREET, LONDON, W.

MANUFACTORY AND SHOW-ROOMS:

BROAD STREET, BIRMINGHAM.

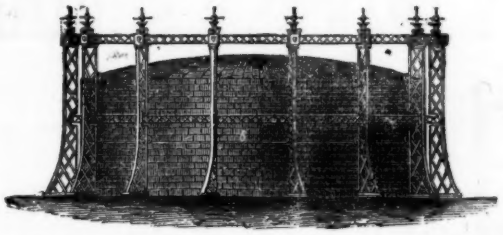
ESTABLISHED 1807.

MANUFACTURERS OF CRYSTAL GLASS CHANDELIERS.

WALL LIGHTS, AND LUSTRES FOR GAS AND CANDLES.

TABLE GLASS OF ALL KINDS.

CHANDELIERS IN BRONZE AND ORMOLU. MODERATOR LAMPS.



THE HORSELEY COMPANY,

LIMITED,

TIPTON, STAFFORDSHIRE.

LONDON OFFICE:

6, WESTMINSTER CHAMBERS, VICTORIA STREET,

GAS ENGINEERS, IRONFOUNDERS, &c.,

MANUFACTURERS OF

GASHOLDERS, WROUGHT AND CAST IRON TANKS, CONDENSERS, PURIFIERS, SCRUBBERS, MAINS, RETORT-LIDS, PLAIN AND DISHED LAMP-POSTS, PIPES,

AND ALL REQUISITES FOR EITHER

GAS OR WATER WORKS;

ALSO

MAKERS OF ROOFS, BRIDGES, &c.

S. OWENS & CO.,

WHITEFRIARS STREET, LONDON, E.C.,

HYDRAULIC ENGINEERS,

AND MANUFACTURERS OF

PUMPING MACHINERY of every Description.

SOLE LICENSEES AND MANUFACTURERS FOR GREAT BRITAIN OF

BLAKE'S PATENT STEAM-PUMPS,

More than 10,000 in use,

ESPECIALLY ADAPTED FOR USE IN GAS AND CHEMICAL WORKS, FOR PUMPING TAR, WATER, AMMONIACAL LIQUOR, ACIDS, &c.

The following are some of the prominent advantages of the BLAKE PUMP:—

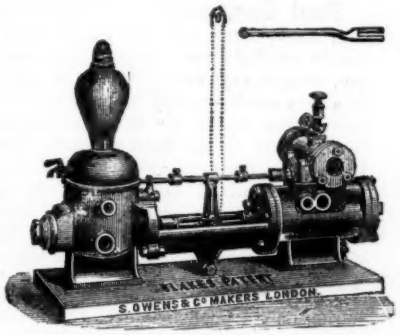
It will start at any point of stroke.

It has no dead point.

It works fast or slow, with the same certainty of action.

It is economical. Has a lead on the slide-valve.

It is compact and durable.



It is interchangeable in all its working parts.

It will deliver more water than any other pump.

It is made of best materials in the most workmanlike manner.

Can be worked at 20 strokes per hour, or 200 strokes per minute.

This Illustration represents Boiler-Feed Pumps, Sizes Nos. 1, 2, and 3, with Hand Lever for working Pump when Steam is not available.

SOLE MANUFACTURERS OF

MANN & OWENS

IMPROVED PATENT GAS-VALVES.

PRICED LISTS AND FULL PARTICULARS FURNISHED ON APPLICATION.

T. NEWBIGGING,

CONSULTING GAS ENGINEER

5, NORFOLK STREET, MANCHESTER.

Established 1799.

ROBERTSONS & CO.,

TWEED-IRON-WORKS,

BERWICK-UPON-TWEED.

Makers of Socket, Flange, and Hot-Water Pipes, Tank-Plates, Lamp-Posts, Columns, Girders, and Gas and other Castings.

THOMAS CARR & SON,

MANUFACTURERS OF

FIRE-BRICKS, LUMPS, TILES, RETORTS, &c.,

COTSWOOD FIRE-BRICK WORKS, SCOTSWOOD-ON-TYNE.

Also Makers of all kinds of Common Building Bricks, and of Pressed White and Red Bricks for Facing.

BIRTLEY IRON WORKS,

CHESTER-LE-STREET,

DURHAM.

Manufactory for every description of Casting and Machinery for Gas-Works and Water-Works.

Warehouse in London for Cast-Iron Pipes and Connexions of all sizes and in any quantity, Scott's Wharf, Bankside, Southwark.

Agent in London, Mr. J. MANWARING, 161 Cannon Street, E.C.

JAMES OAKES & CO.,

ALFRETON IRON-WORKS, DERBYSHIRE,

AND

WENLOCK IRON WHARF, 21 & 22, WHARF ROAD, CITY ROAD, LONDON, N.,

Manufacture and keep in stock at their works (also a large stock in London) PIPES and CONNECTIONS 1½ to 48 inches in diameter; and make to order Retorts, Purifiers, and Tanks, with or without planed joints, Columns, Girders, Special Castings, required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Syphons and Covers are joint-faced if required, doing away with millboard and iron boring, or Syphons made without Covers, a socket being cast on and fitted with a small plug about 6 inches in diameter with lead joint. In either way preventing leakage.

THE

SILICA FIRE-BRICK CO.,

OUGHTIBRIDGE

Near SHEFFIELD,

Manufacturers of THE ORIGINAL SILICA OR DINAS FIRE-BRICKS. Specially adapted for Gas-Retort Furnaces and for Siemens's Gas-Furnaces. Shipments promptly executed to London, Liverpool, Hull, Grimsby, &c.

TROTTER, HAINES, & CORBETT,

BRETTELL'S ESTATE

FIRE CLAY & BRICK WORKS,

STOURBRIDGE.

Manufacturers of GAS-RETORTS, GLASS-HOUSE FURNACE & BLAST-FURNACE BRICKS LUMPS, TILES, and every description of FIRE-BRICK.

Proprietors of

BEST GLASS-HOUSE POT and CRUCIBLE CLAYS.

Successors to

E. BAKER AND CO., LATE BRIERLEY HILL, STAFFORDSHIRE.

HARPER & MOORES,

PROPRIETORS OF THE

BEST STOURBRIDGE CLAYS,

STOURBRIDGE.

Manufacturers of all Descriptions of

BEST STOURBRIDGE FIRE-BRICKS, LUMPS AND CLAY RETORTS

Of all Dimensions for Gas-Works,

GLASS-HOUSE POTS & CRUCIBLES

ESTABLISHED 1835.

The Highest Award was obtained by H. & M., at the Philadelphia Exhibition, 1876, for Superior Quality of Manufacture. SILVER MEDAL, PARIS, 1878.

GAS AND WATER PIPES.

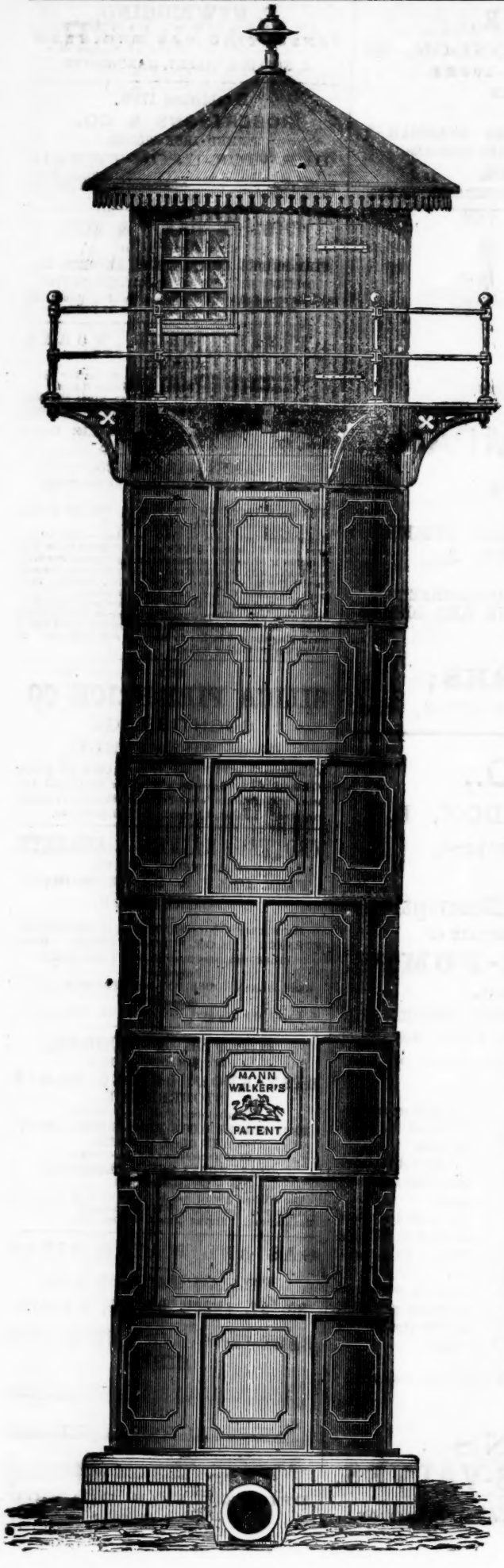
WILLIAM MACLEOD & CO.,

30, ST. ENOCH SQUARE, GLASGOW.

CAST-IRON GAS AND WATER PIPES.

DELIVERY F.O.B., GLASGOW.

Prices on application.



C. & W. WALKER,
8, FINSBURY CIRCUS,
LONDON, E.C.

MANN & WALKERS' PATENT SCRUBBER.

By Letters Patent in Great Britain, Europe, and the United States of America.

By some important improvements recently patented, the purifying power of these Scrubbers has been much increased, and a stronger ammoniacal solution obtained, which is found to absorb a large portion of the carbonic acid contained in gas, effecting an important saving in money and labour in the lime purifiers, and where oxide only is used, the increase in the illuminating power of the gas obtained by these Scrubbers is shown in a remarkable degree, in consequence of the large quantity of carbonic acid removed from the gas.

It is to be particularly noted that the important results of these Scrubbers do not depend upon the machinery alone. The entire internal construction of the Scrubber bears an almost equally important part. For this reason, where it is desirable to convert existing Scrubbers, whose dimensions happen to be suitable, the work commences by ripping out the whole of the interior of the shell, and beginning the internal construction *de novo* from bottom to top.

Fifty million cubic feet of gas per 24 hours are purified from ammonia by these Patent Scrubbers in a winter's day in the gas-works of London, where the purity of gas supply is the highest in the world, under the chemical restrictions of the Board of Trade.

Generally, wherever a high standard of purification is maintained in the chief cities and towns of the British Provinces and of Europe, these Scrubbers have become established.

By their use the department of purification from ammonia upon a gas-works is made complete, without the aid of prepared oxide of iron, chemicals in purifiers, or any other supplementary process, and the whole ammoniacal residual product contained in the coal is absorbed and obtained in the form most profitable to a gas company, while the requirements of all Acts of Parliament and of the Board of Trade, relating to incorporate gas companies, are satisfied.

Foul Gas, properly condensed, entering the inlet is, by once only passing through the Scrubber, completely purified from ammonia with regular certainty day by day, without any further trouble, or any other process, effected by a very small quantity of clear water let into the machinery room at the top of the Scrubber, which is discharged at the liquor outlet at the bottom, from Newcastle coal at about 18 to 20 ounces strength, from Yorkshire and other coals generally from 25 to 30 ounces strength; while acidulated litmus or turmeric exposed at the Scrubber outlet will not show the slightest discoloration, and there is not a quarter of a grain of ammonia per 100 feet left unabsorbed.

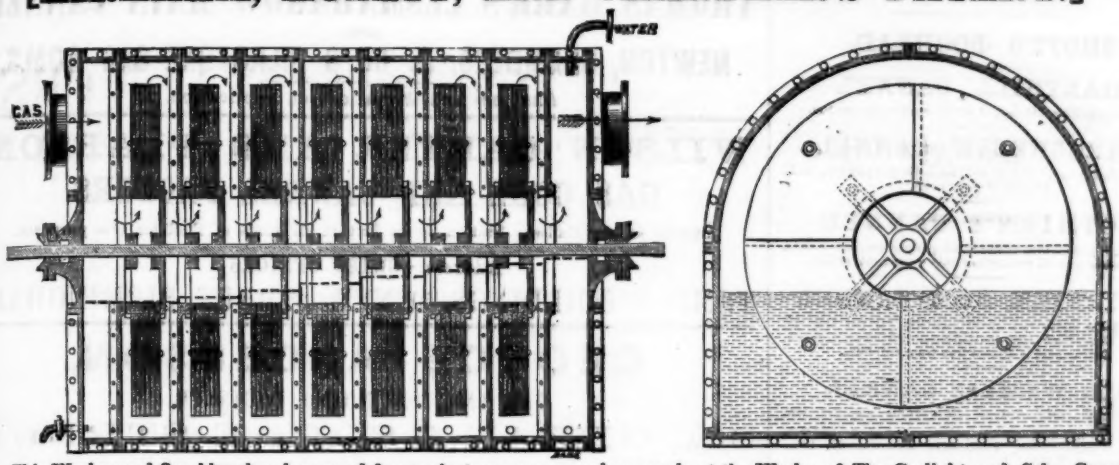
They contain their own engine power, requiring only a small inappreciable quantity of steam from the gas-works boiler, and are then complete in themselves, ready for service.

Applications relating to dimensions and prices should be addressed to us, C. AND W. WALKER, 8, FINSBURY CIRCUS, LONDON, E.C., or to Mr. WILLIAM MANN, late Superintendent of the Chartered Gas-Works, BLACKFRIARS, LONDON; they should state approximately the largest make of gas in 24 hours on a winter's day, and the smallest make on a summer's day, to be purified.

THE

"STANDARD" WASHER & SCRUBBER.

[KIRKHAM, HULETT, AND CHANDLER'S PATENT.]



This Washer and Scrubber has been used for nearly two years on a large scale at the Works of The Gaslight and Coke Company, Bromley-by-Bow, at which station there are now several in operation and in course of construction. There is also one in use at the Pancras Station, King's Cross, of the same Company, which is purifying 1,500,000 cubic feet of gas per day. At the Gas-Works of the Corporation of Leeds, a large one has been erected, which is giving complete satisfaction. The Special Merits of this Washer are as follows:—

That it is a very effective Condenser, so that it is not absolutely necessary to reduce the temperature of the gas to 60°, or thereabouts, to make the Washer effective. That the distribution of the liquor is made with unerring regularity. That it occupies very small space, so that it can be, at little expense, effectually protected from extreme changes of the weather. That the considerable expense of Coke or Wood, or other Scrubbing Material, is entirely saved, and that the great nuisance and cost of from time to time replacing the Scrubbing Material is avoided. That, by the revolution of the discs, the quantity of water carried up by them, and tending continuously to fall, exposes a very large amount of fresh wetted surface to contact with the gas. That it is particularly adapted for Gas-Works where Sulphate of Ammonia is manufactured. That it is much cheaper than any other Scrubber that will do the same amount of work effectually. That it is the only Washer suitable for purifying Gas from all its impurities by solution. That it works with a minimum of pressure. That it takes out every trace of Ammonia from the Gas in once traversing the machine. That it requires very little outlay for foundations.

The following Testimonials show the opinion of eminent Engineers as to the capabilities of the Washer:—

D. HULETT, Esq. *The Gaslight and Coke Company, Bromley-by-Bow, May 3, 1877.*

Dear Sir,—In answer to your inquiries respecting the results of the working of your Patent Washer, I beg to state that I find it a very efficient machine. I have had it in operation for some time, and passed gas through it continuously at the rate of 100,000 cubic feet per hour, and obtained from it 11 gallons of 10 oz. liquor per ton of coal carbonised—results which appear to me very satisfactory for so small a Washer. It works very smoothly, taking but little power, and giving no pressure. I have it still in operation, and am perfectly satisfied with its working.

I am, dear Sir, yours truly, (Signed) W. B. WRIGHT.

Messrs. KIRKHAM, HULETT, and CHANDLER. *The Leeds Corporation Gas-Works, York Street, Leeds, Dec. 6, 1878.*

Gentlemen,—The Scrubber-Washer erected by you at these works, and which has been in use for six months, has proved to be, so far as we have been able to test it, thoroughly efficient. We are at present making 32,000 feet of gas per hour, and are entirely dependent on this apparatus for the removal of Ammonia, and the **Gas is perfectly free from that impurity in the sixth chamber**, so that four chambers remain to deal with an increasing make of gas. Owing to insufficient condensers, the gas was in the summer admitted to the Scrubber at a temperature of 70°, but was reduced therein to 61°, or that of the atmosphere. The voltes are driven at the rate of four revolutions per minute, and, working at that speed, there is not the slightest difference between the inlet and the outlet pressure. Clean water supplied at the rate of 10 gallons per ton of coal carbonized is converted into liquor of from 10 oz. to 13 oz. strength **in once traversing the vessel.** The apparatus is extremely simple and compact, occupies but little space, and requires no foundation. I shall be surprised if it does not eventually become extremely popular.

I am, Gentlemen, yours faithfully, (Signed) HENRY WOODALL, Engineer.

Messrs. KIRKHAM, HULETT, and CHANDLER. *The Gaslight and Coke Company, York Road, King's Cross, Jan. 14, 1879.*

Gentlemen,—In reply to your inquiry, I am pleased to say, the Washer which was put in action at this station in October last has quite fulfilled my expectations, as it confirms the experiments I made in May last with the smaller machine. Working at four revolutions per minute, it **takes out every particle of Ammonia**, while purifying more Gas than it was intended to do. I enclose particulars of a fortnight's working during our heaviest make, by which you will see that it yields the full quantity and strength of liquor, and works with little pressure. I am therefore quite satisfied with the machine, and trust it may meet with the success it deserves.—I remain, &c. (Signed) JOHN CLARK.

The following Table shows the results of the working of one of these Washers, lately erected to purify 60,000 feet of Gas per Hour, at the St. Pancras Station of The Gaslight and Coke Company:—

1879.	Nos. of the Divisions and Strength of Liquor in each.										Water used per Ton of Coals.	Gas Purified per Hour, Cubic Feet.	Ammonia on Outlet.	Temperature.			Pressures.		Revolutions per Minute.
	1	2	3	4	5	6	7	8	9	10				Inlet.	Outlet.	Atmosphere.	Inlet, Inches.	Outlet, Inches.	
	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.	oz.									
January 1	8¼	6¾	5	3½	2½	1½	¾	¼	0	0	10 Gallons.	52,000	Nil.	77°	73°	48°	24	23	7½
„ 2	8¾	7	6	4½	3½	2½	1½	¾	¼	0	10 „	57,000	Nil.	73°	66°	32°	21½	20½	4
„ 3	9¼	8	6	3¾	3	2½	1½	¾	¼	0	10 „	60,000	Nil.	75°	68°	40°	23½	22	4
„ 4	9¼	7¾	6¼	4¼	3¼	2½	1½	¾	¼	0	10 „	65,000	Nil.	74°	68°	38°	24	22½	5
„ 5	9¼	7	6	4	3	2½	1½	1	¼	0	10 „	34,000	Nil.	77°	68°	35°	14½	14	5
„ 6	9¼	7¼	6¼	4¼	3	2½	1½	1	¼	0	10 „	63,000	Nil.	72°	66°	27°	24	22½	4½
„ 7	11	9	7	5¼	3¾	3	1½	1¼	¼	0	10 „	59,000	Nil.	74°	66°	31°	25	23½	5
„ 8	9½	7½	6	4½	3	2	1	¼	¼	0	10 „	78,000	Nil.	73°	61°	31°	28	26½	4½
„ 9	11	9	7	5	3¾	2½	1½	1	¼	0	10 „	82,000	Nil.	74°	67°	33°	27½	25½	5
„ 10	10¾	8½	6¾	5	3½	2½	1½	1	¼	0	10 „	66,000	Nil.	76°	64°	28°	28½	27	5
„ 11	12½	10	7¾	5¾	4¼	3¼	1½	1	¼	0	10 „	61,000	Nil.	78°	64°	27°	26½	25½	5
„ 12	11	8¾	6¾	—	—	—	1½	1¼	¼	0	10 „	39,000	Nil.	74°	64°	27°	26½	25½	5
„ 13	13	10¾	8¼	6	4¾	3½	2	1½	¼	0	10 „	78,000	Nil.	73°	65°	42°	28	26	5

Messrs. KIRKHAM, HULETT, and CHANDLER. *Corporation of Birmingham, Gas Department, Saltley Works, May 23, 1879.*

Gentlemen,—I beg to enclose you a copy of the results of the tests which, by the kind permission of the Engineer, Mr. Clark, I made on the 6th of March last, of the working of one of your "Standard" Washers and Scrubbers at the St. Pancras Station of The Gaslight and Coke Company, and I am of opinion that, for an apparatus occupying so small a space, they are exceedingly satisfactory.—Yours truly, HENRY HACK, Engineer.

Working Results obtained from KIRKHAM, HULETT, *and* CHANDLER'S *Patent "Standard" Washer and Scrubber at the St. Pancras Station of The Gaslight and Coke Company, London, March 6, 1879.*

Gas passing per Hour, Cubic Feet.	—	Impurities in Gas per 100 Cubic Feet.			Temperature.		Pressure in Inches.	Revolution of Apparatus per Minute.	—	No. of Divisions and Strength of Liquor.										Water Used during Experiment. Gallons.
		SH_2	CO_2.	Grains. NH_3.	Washer.	Air.				—	—	—	—	—	—	—	—	—	—	
64,000	Inlet	2·00	2·00	158·8	72	57	21	4½	Twaddel deg. at 60°	5·3	4·9	2·85	2·35	1·7	1·05	0·6	0·3	0·15	0·1	63
	Outlet	1·50	1·50	0·8	68	57	20		Acid, ounces.	11·0	8·4	6·3	4·5	2·7	1·7	1·3	0·7	0·3	—	

WASHER-SCRUBBERS OF THIS PATENT ARE IN COURSE OF CONSTRUCTION FOR BECKTON, BRADFORD, GREENWICH, WOOLWICH, AND SEVERAL OTHER GAS-WORKS.

For further particulars and testimonials, address

Messrs. KIRKHAM & HERSEY, GAS ENGINEERS, 21, ABINGDON STREET, WESTMINSTER.

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

198, ST. VINCENT STREET, GLASGOW.

SHOTT'S BOGHEAD.

HARTHILL . CANNEL

Yields 14,920 cubic feet of 40·92-candle gas per ton.

THRASHBUSH CANNEL

12,530 cubic feet of 40·22-candle gas per ton, and 9 cwts. of good coke.

LOTHIAN'S CANNEL

Yields 12,500 cubic feet of 34-candle gas per ton, and 9 cwts. of excellent coke, containing only 4 per cent. of ash.

MUIRKIRK, No. 1, CANNEL

Yields 12,160 cubic feet of 32·5-candle gas per ton, and 10 cwts. of excellent coke, containing only 5 per cent. of ash. This cannel is almost free from sulphur.

OLD WEMYSS CANNEL

Yields 13,320 cubic feet of 32·5-candle gas per ton.

Prices and full analyses on application at above address, or from WEDDERSPOON, FERGUSSON AND CO., 21, Lime Street, LONDON, E.C.

GAS COAL.

THE MIRFIELD COAL COMPANY are supplying GAS COAL of the best quality on trucks at their siding. This Coal contains 10 per cent. of Cannel, and, as analyzed by Mr. James Paterson, of Warrington, yields 12,600 *cubic feet of* 16·67 *candle gas, with* 1480 *lbs. of good Coke, per ton.* Ash in Coke, 1·88.

Apply to the MIRFIELD COLLIERY, Mirfield, NORMANTON. London Agents: SMITH BROS., 35, THROGMORTON ST., E.C.

HEBBURN MAIN GAS COAL.

This Coal is now highly approved of for gas making, and yields over 10,000 feet per ton of 15-candle gas, and about 14 cwt. coke.

For references and prices, either f. o. b. or by rail, apply to

W. RICHARDSON,

29, QUAYSIDE, NEWCASTLE-ON-TYNE.

GAS COAL.

THE Tawd Vale Colliery Company, Limited, are prepared to Contract for the Supply of their superior Arley and other GAS COALS, and to send samples to the order of Gas Engineers and others, or complete analysis on application. Shipped at Liverpool, Preston, Fleetwood, Garston, or Birkenhead.

Mr. James Paterson, C.E., F.G.S., in his analysis of T. V. Arley Coal, says: "Some parts merge into a semi-Cannel; Gas per ton, 10,300 cubic feet; illuminating power, 16·96 candles; coke of high quality, 1431 lbs per ton."

Collieries, Skelmersdale, near Ormskirk; Offices, 5, New Hall, Old Hall Street, LIVERPOOL.

GAS COAL.

POPE & PEARSON, LIMITED, have now the authority of several of the most eminent Gas Engineers of London in stating that their Coal yields *in practical working over* 10,000 *cubic feet of gas, with an illuminating power of* 16 *candles;* or by the standard burners now used by the London Gas Companies, an illuminating power equal to 17½ candles.

One ton yields 12½ cwt. of good coke. This Coal can be shipped from Hull, Goole, Liverpool, Morecambe, and Barrow.

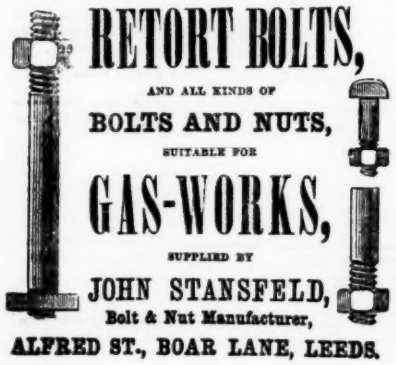
For further particulars, apply to POPE AND PEARSON, LIMITED, West Riding and Silkstone Collieries, near LEEDS.

M. BREMOND'S NAPHTHALINE PROCESS.

A negotiations respecting M. Brémond's patented process for preventing Deposits of

NAPHTHALINE

in Gas Main and Service Pipes should be addressed to Mr. W. H. BENNETT, 22, Great George Street, WESTMINSTER, S.W., or to M. BREMOND, Gas Engineer, Companie Madrilena de Alumbrado y Calefaccion por Gas, MADRID, who may be consulted upon all matters connected with the Gas Industry.



RETORT BOLTS,

AND ALL KINDS OF

BOLTS AND NUTS,

SUITABLE FOR

GAS-WORKS,

SUPPLIED BY

JOHN STANSFELD,

Bolt & Nut Manufacturer,

ALFRED ST., BOAR LANE, LEEDS.

FERRAND DAVIES,

148 GRESHAM HOUSE, OLD BROAD STREET, LONDON, E.C.,

AGENT FOR

THOMAS BARR'S LESMAHAGOW MAIN CANNEL,

AND

NEWTON, CHAMBERS, & CO.'S SILKSTONE GAS COALS.

Analyses and Quotations on application.

WILSON CARTER AND PEARSON,

GAS COAL AND CANNEL FACTORS,

Supply to any Railway Station or for Export all kinds of Fuel for Gas purposes.

Address—CHIEF OFFICES:

TEMPLE BUILDINGS, 50, NEW STREET, BIRMINGHAM.

GEORGE ANDERSON,

GAS AND CONSULTING ENGINEER,

35A, GREAT GEORGE STREET,

WESTMINSTER, S.W.,

PATENTEE and MANUFACTURER of the following Inventions:—

RETORT SETTINGS—giving great Economy of Fuel.

STEAM-ENGINES and EXHAUSTERS, FOUR-WAY VALVES, WASHERS, SCRUBBERS.

FUEL-MACHINE, for Compressing Breeze and Tar.

N.B.—Pamphlet, with Eighteen Illustrations and Letterpress on the Construction of Gas-Works, post free, 2s. 6d.

PRICES AND ALL PARTICULARS TO BE HAD OF THE PATENTEE,

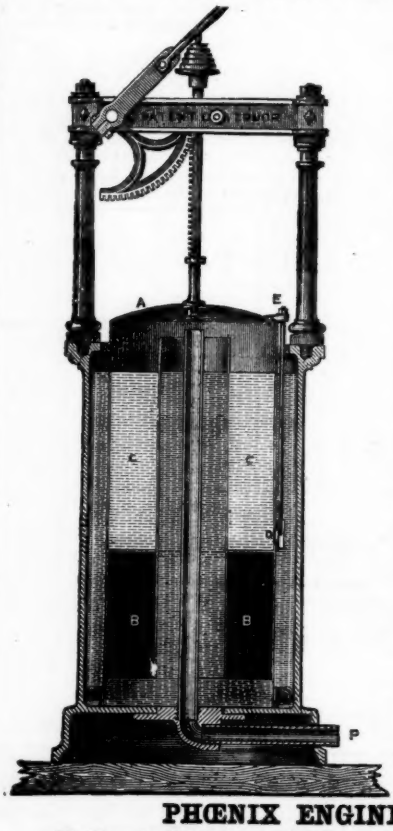
35a, GREAT GEORGE STREET, WESTMINSTER, S.W.

GEORGE WALLER & CO.,

GAS AND HYDRAULIC ENGINEERS,

Patent Compensating Steam Governor,

WITH SELF-CONTAINED WATER-BALANCE.



DESCRIPTION OF THE APPARATUS.

The illustration represents a section of the Patent Governor. The lower part of the Bell A is fitted with a loose Float B, and in the upper part of the Bell is a deep annular Water Chamber C, at the bottom of which is an opening D, with a slide outside regulated by a Screw Spindle E, to allow the water to pass in and out of the Chamber C quickly or slowly, according to circumstances, but when once adjusted the slide does **not require altering.** This Self-compensating Chamber gives great steadiness to the up and down movement of the Bell and effectively prevents the "hunting" motion so common with other Governors, thereby ensuring a more perfect action on the throttle-valve of the Engine **than attained by any other.** The sketch shows the clip lever fixed to work on throttle-valve at an angle, and can work in either direction. P is the Gas Inlet-pipe to Governor.

G. W. & Co. also make **special Steam Throttle Valves,** suitable for working with this Governor, and alter existing Throttle Valves to same plan.

PHŒNIX ENGINEERING WORKS,

Holland Street and Bear Gardens, Southwark, S.E.

THE SILKSTONE & DODWORTH COAL & IRON COMPANY, LIMITED,

DODWORTH, BARNSLEY.

BENJAMIN WHITWORTH, Esq., M.P. . . . . Chairman.
Mr. RICHARD HARTLEY . . . . . Managing Director.

REAL OLD SILKSTONE GAS COAL.

JAMES PATERSON Esq., Gas Engineer, of the Warrington Gas Company, reported, Aug. 10, 1875:—
"This Coal possesses remarkable qualities as a gas and coking coal, and appears SECOND TO NONE IN THE KINGDOM. It contains the large quantity of 699 lbs. of illuminating matter, and 1498 lbs. of coke to the ton, and produces **12,240** cubic feet of 16·66 candle gas."

The above Company are raising nearly a thousand tons of the Real Old Silkstone Gas Coal per working day.

PRICES QUOTED TO ANY RAILWAY STATION, OR F.O.B. HULL, GRIMSBY, GOOLE, KEADBY, LIVERPOOL, AND FLEETWOOD.

ALDER AND MACKAY,

MANUFACTURERS OF

IMPROVED WET AND DRY GAS-METERS

IN CAST-IRON AND TIN CASES OF THE HIGHEST EXCELLENCE.

Original Manufacturers of Dry Meters in Cast-Iron Cases.

STATION-METERS, EXPERIMENTAL-METERS, PHOTOMETERS, & PRESSURE-GAUGES, &c.

GRANGE WORKS, EDINBURGH.

PARIS EXHIBITION, 1878.

THREE MEDALS
AND
HONOURABLE MENTION
HAVE BEEN AWARDED TO
JOSEPH CLIFF & SONS
For their Various Exhibits, amongst which is a
SILVER MEDAL
FOR THEIR
PATENT MACHINE-MADE
RETORTS AND FIRE-BRICKS,
Being the Highest Honour given for this class.

Established

1795.

JOSEPH CLIFF & SONS,

THE ORIGINAL
WORTLEY FIRE-BRICK WORKS,
NEAR LEEDS,
London Wharf: No. 4 inside Great Northern Goods Station, King's Cross, N. Liverpool: Leeds Street.

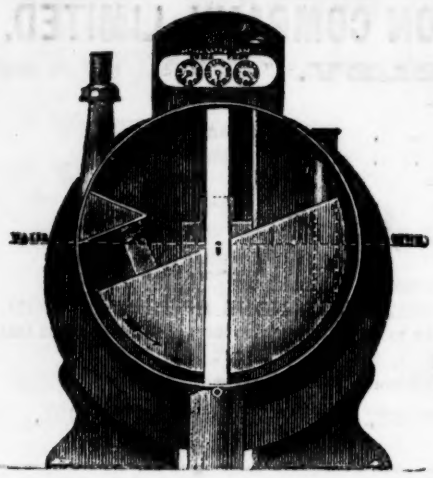
SPECIAL NOTICE.—Our Patent Machine-Made Retorts have now been thoroughly tested, and have proved themselves infinitely superior to those made by hand. At several large works it has been settled, beyond question, that, owing to the compactness and general excellence, more gas is sent to the gasholder from each ton of coal carbonized than is the case with hand-made Retorts.

LIVESEY'S PATENT WASHER.

This apparatus effects the most intimate contact between the liquor with which it is supplied and the gas passing through it, resulting in the complete removal of all particles of tar, increasing the ammonia strength of the scrubber and condenser liquor, and removing a large proportion of other impurities—notably, carbonic acid. The Washer is intended to work in conjunction with a scrubber. It occupies little space, and is inexpensive. It has been in successful constant use for nearly three years, does not become clogged with tar or corroded by the action of the liquor or gases, it gives three inches of pressure, and only needs a supply of liquor to keep it in regular action without any further attention.

For Particulars and Prices apply to

Messrs. DEMPSTER AND SONS, ELLAND, HALIFAX, for the North;
Messrs. BAILEY, PEGG, AND CO., Bankside, LONDON, S.E., for the South;
Messrs. WILLEY AND CO., Commercial Road, EXETER, for West of England and South Wales
Or to the PATENTEE, 589, OLD KENT ROAD, LONDON, S.E.



THE
UNVARYING WATER-LINE GAS-METER.
(SANDERS AND DONOVAN'S PATENT.)

"Unquestionably the best Water Gas-Meter now in use."—THOS. G. BARLOW, C.E.

Over 120,000 in action.

MANUFACTURERS:

THE GAS-METER COMPANY, LIMITED,
KINGSLAND ROAD, LONDON;
WITH
Branch Manufactories at DUBLIN and OLDHAM.

ALEXANDER WRIGHT & CO.,
MANUFACTURERS OF
"WET" AND "DRY" GAS-METERS,
STATION-METERS, AND GOVERNORS.
METERS, BOXES, REGULATORS, AND ALL REQUISITES FOR PUBLIC LIGHTING.
TESTING APPARATUS for all purposes relating to Gas, &c.
MR. VERNON HARCOURT'S COLOUR TESTS,
Descriptive particulars, per post, 2d.

55, 55a, & 56, MILLBANK STREET, WESTMINSTER,
LONDON, S.W.

R. LAIDLAW AND SON,
EDINBURGH AND GLASGOW.
Manufacturers of
CONSUMERS IMPROVED WET GAS-METERS,
THE UNVARYING WATER-LINE GAS-METERS,
IMPROVED DRY GAS-METERS, in Cast-Iron or Tin-Plate Cases;
STATION-METERS, ALL SIZES, up to 15 feet Square, with PLANED JOINTS;
Experimental Meters, Photometers, Pressure-Gauges,
Governors, Test Holders, &c., &c.
LONDON OFFICE:
6, LITTLE BUSH LANE, CANNON STREET, E.C.

IMPROVED HYDRAULIC CRANES,
Effecting a great saving in the cost of discharging Coals from Vessels, Barges, &c. Several of these Cranes, with the necessary power, are now being erected at Beckton, Hull, and other Gas-Works.
HYDRAULIC APPARATUS for Lifting and Lowering Purifier-Covers.
Sixteen recently erected at Beckton, applied to Covers 30 feet square.
SULPHATE OF AMMONIA APPARATUS,
IN SUCCESSFUL OPERATION AT THE NEW WORKS OF THE NEWCASTLE AND GATESHEAD GAS COMPANY,
AND IN COURSE OF ERECTION AT THE CARLISLE CORPORATION GAS-WORKS.
Special "REGULUS COCKS" manufactured to stand Acid.
FOR PARTICULARS, APPLY TO
JOHN ABBOT & CO., LIMITED,
2, SUFFOLK LANE, CANNON STREET, E.C., or PARK WORKS, GATESHEAD-ON-TYNE.

London: Printed by WALTER KING, for the Executors of the late WILLIAM BOUGHTON KING (at the office of Clayton and Co., 17, Bouverie Street, Fleet Street), and published by him at No. 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, August 5, 1879.